



ORC at National Organic Combinable Crops 2017

We are partners in NOCC 2017 - National Organic Combinable Crops - OF&G's flagship event, which is the largest UK on-farm event in the organic calendar. We were lucky that this year it was held just down the road from us at Fullerton Farms Partnership, near Andover in Hampshire. That meant that we were able to be more involved than ever, bringing our expertise on intercropping, cereal diversity, use of on-farm woody resources, and measuring the life in your soil to the event. **Phil Sumption** rounds up our activity at NOCC 2017.



Martin Wolfe on the morning's panel, chaired by Charlotte Smith, on 'Seed quality: breeding and selection and harvest'.



ORC stand



Nic Lampkin makes a point in the morning's discussion



Trees and hedges can present management challenges for farmers, but could be an untapped resource. Sally Westaway from the agroforestry team at the ORC was joined by William Hamer, forestry consultant and director of Hampshire Woodfuel Cooperative, to discuss the pros and cons of managing on-farm woody resources including hedges and small woodlands as a productive part of the farm enterprise.



Katie Bliss flies the banner for AgricoLOGY



Principal Crop Researcher Ambrogio Costanzo with a sample of ORC Wakelyns Population. Ambro took attendees through a history of wheat breeding with examples of ancient cereals to modern day.



ORC researcher Anja Vieweger demonstrating practical soil assessment methods indicative of soil biology including, simple spade tests, visual soil assessment (colour, smell etc.), and earthworm counts.



Crops Researcher Dominic Amos explains the intercropping trials

ORC staff enjoying a NOCC breakfast!





Retro wheats for food diversity in organic systems

Wheat is the most common of all cereals and you would be forgiven for thinking that only one species exists, especially since it accounts for about 95% of the wheat grown¹. Actually, there are several members of the genus *Triticum* that have been cultivated over the last 10,000 years but many of these 'ancient' types have been forgotten. Einkorn, emmer and rivet were all once widely grown and now, as part of the Diversifood project, ORC is undertaking research into these ancient wheat species to evaluate their suitability for organic production in the UK. **Dominic Amos** takes up the story, re-told in plots at NOCC 2017.

The wheat we grow now, *Triticum aestivum*, is the result of a natural hybridisation between two wild species of grass, emmer (*Triticum dicoccoides*) and goat grass (*Aegilops tauschii*), 10,000 years ago. The origin of cultivated wheat began with einkorn (*T. monococcum*) with other types such as emmer (*T. dicoccum*) and durum (*T. turgidum* subsp. *durum*) occurring through further hybridisations and natural genetic differentiation.

Over centuries of selective breeding, and the last few decades of modern industrialised agriculture, we are left with one dominant type of wheat, commonly known as 'bread wheat', although spelt and durum do have their place.

Exploring the agronomic characteristics of these ancient wheats for their potential in organic systems is one of the tasks of the Diversifood project. The aim is to increase the diversity of crops on farm and, as a result, the diversity of food on our plate. It's also important to recognise the heritage and traditions surrounding many of these crops which were widely grown by our ancestors. For example, several recipes still exist though are no longer used. Furthermore, these species represent a broad genepool with huge potential for further breeding improvement in wheat in general.

ORC has been growing several accessions of einkorn, emmer and rivet at Doves Farm for the last two years. Doves is known for its speciality flours and in fact grows its own emmer and einkorn, making it an ideal partner given the whole chain approach focus of the Diversifood project. The varieties grown commercially at Doves have come from the Hungarian Academy of Sciences and are the result of an organic breeding programme to develop suitable einkorn and emmer crops for low input systems. Actually, the crops are already suited to low-input agriculture, having not undergone the same extreme selection under high-input conditions as our modern bread wheats. Many of the varieties we're growing in our experiment have been sourced from gene banks across Europe. Most of the einkorns and emmers are from Hungary and several rivets have come from ITAB in France, although we're growing two old English landraces (Bluecone and Rampton) that were sourced from the John Innes Centre Germplasm Resource Unit.

Agronomically speaking, einkorn looks to be the most promising species for UK cultivation, with its strong ability to tiller and to mine nutrients, its disease resistance and its competitiveness. In our trials at Doves farm the ancient wheats have outperformed the bread wheats in almost every category. What remains to be seen is whether this will translate into higher yields, especially since due to the much taller nature of the ancient wheats, lodging can be an issue.

Experience has shown that some of these accessions could be very useful as a second or third cereal in a rotation or for areas of the farm where soil conditions are poor.

Something else we have learnt this year is that on higher fertility land, the risk of lodging is high and if seed rates aren't adjusted accordingly then the ancient wheats can fall down. This year for NOCC, we drilled plots of einkorn, emmer and rivet but unfortunately, as a result of high fertility in the field, slightly high seed rates and wet and windy weather in mid-June these have all lodged. We have even seen lodging in the Wakelyns Population, which



Rivet: Percival's Blue Cone

no-one at ORC has encountered before. What this does highlight is that species and variety selection should be farm specific and what may prosper somewhere will not necessarily perform in other environments. In fact, for the demo plots at this year's NOCC event, the best looking crops are unsurprisingly the crops the farmer has in his rotation, showing there's no substitute for trial and error and your own experience.

One aspect that will be explored by Diversifood project partners is the nutritional and nutraceutical properties of the grains, with some research already suggesting increased levels of phytochemicals beneficial for health including antioxidants such as phenolics, flavonoids and carotenoids^{2,3}. In fact the flour of both einkorn and emmer is a creamy yellowish hue due to the high carotenoid content. The einkorn flour can be used in bread but is of particular interest for malting to make beer. Emmer flour can be used in bread, biscuits and cakes. Rivet wheat, a close relative of durum, and believed to have been brought over to Britain by the Normans, is being grown with the expectation that it can be used to provide a source of flour for British grown pasta. The straw is also strong and can be used for thatching. Rivet wheat is free threshing and therefore doesn't pose the processing issues that hulled wheats like spelt, einkorn and emmer do.

References

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'Better together!'

We know from plant ecology that in nature diverse communities generally work better than uniform ones^{1,2}. These benefits can also be obtained in agroecosystems where the growing of two or more crops together simultaneously in the same piece of land has been shown to be beneficial in terms of yield stability, increase in total yield, pest and disease management, weed management, erosion control, and soil fertility^{3,4,5}.

Dominic Amos reports on work investigating the potential of intercropping as a practice for building resilient cropping systems, as part of the Diversifood project.

Trials are being carried out at the University of Reading Sonning Farm looking at spring wheat and beans in combination, with different spatial arrangements (alternate or mixed rows), through the EU Horizon 2020-funded Diversifood project. A spring version of the ORC Wakelyns population is also being tested, to compare its performance in an intercropping situation compared to a standard elite line, and also to apply a selection pressure in order to encourage adaptation as an intercropping component. The Spring population has been developed by continued spring sowing of the winter population which has selected for genotypes with a lower vernalisation requirement and a shorter growing season. Plots that include both a bean and a wheat population will continue to be grown each season to monitor both adaptability and yield stability. Results from this experiment will be available in the next Bulletin.

As well as the trial at Reading, various intercropped plots were drilled for NOCC 2017 and were on show for visitors to view. Various wheat and bean mixtures (all mixed rows) have been sown, including two elite bean cultivars, Vertigo and Fuego, and a bean composite cross population developed in the SOLIBAM project. We've again included a spring wheat population as well as the two elite wheat lines, Mulika and Paragon. The idea is to look at how varietal selection can make a difference when designing crop partnerships and to think about some of the other key considerations including spatial arrangement, drilling rates and canopy height.



Intercropping spring beans and wheat trials at Sonning Farm

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Research has shown that a 50:50 mix does not always perform best. We also included plots of various spring cereals (wheat, barley, oats and triticale) and pea mixes from Western Seeds CombiCrop blends, although unfortunately at the time of writing the peas had failed to come through due to the incredibly dry spring. It could be argued that this is one of the benefits of an intercrop as risk is spread so that if one crop fails a second is able to take its place and continue to provide the farmer with a crop.

The idea behind mixing a cereal and grain legume is to provide a feed high in both protein and starch, giving a boost to protein by up to 50% above that of a straight cereal. Foliar disease risk in the cereal is reduced, and residual nitrogen is left by the peas for the following crop. The cereal-legume canopy architecture is complementary, with the cereal providing support for the pea to climb. Peas will ripen a little earlier than the wheat or oats but will hold on until the cereal component is ready to harvest. The peas and barley should come at the same time. These cereal/pea blends can be combined dry, crimped or wholecropped, and the straw is also very palatable. Growing these mixes could help reduce or even eliminate the need for bought-in concentrate.

Finally, although not part of the intercropping showcase, a plot of Carlin peas, also known as Black peas or black badger peas has been drilled, and despite the dry conditions has come through very well. Carlin peas (*Pisum sativum* var. *arvense*) are being grown by Hodmedod's, the innovative British pulse and grain retailer, and can provide a very suitable British-grown substitute to both chickpeas and lentils.

An intercropping event was held at the beginning of June at Shimpling Park Farm, as part of the OK-Net knowledge exchange project, with farmers from France experienced in intercropping practice sharing their experiences.

A new project focusing on intercropping called Diversify has just started and will explore the practice in depth over the next few years (see p18).

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ORC Wakelyns Population



Harvesting ORC Wakelyns Population. Photo: Mark Lea

Seed of the **ORC Wakelyns Population** is on sale for this autumn. This is a good opportunity to get a new concept of wheat into your field.

What is it? It is not a variety, as individual plants are not identical, and it is not a mixture either. Think of it as a crowd, in which each plant is different from each other. It is the outcome of 107 crosses between 20 parents, selected to be either high quality or high yielding, bulked and reproduced year after year in organic farms.

How does it work? Its performance builds upon 'four Cs': **Capacity**, as it has high phenotypic variation; **Complementation**, as different individuals can complement each other; **Compensation**, as, if some fail, others will take their place and the whole will recover, and **Change**, as evolutionary changes make the best performing types to be prevalent in response to environmental selection.

How does it grow? Thanks to the 'four Cs it performs well in organic farms, because that's where it has been reproduced, being productive, stable and resilient. In fact, the Wakelyns population is able to withstand stresses thanks to its diversity. For instance, it has resistances to pests and diseases for two reasons: first, being a crowd of different types, it does not offer a uniform breeding ground for pests and diseases to spread; second, having been reproduced in organic farms in the UK, it 'knows' the local pests and diseases it has been exposed to better than us, as it selected itself to be resistant to them. It is also able to withstand all those unpredictable stresses that commonly threaten the performance of common varieties. Several times we have seen it performing very well when sown in suboptimal conditions, e.g. much later than recommended, whereas common, uniform varieties sown in the same place and in the same way have completely failed.

How does it taste? It has a good baking quality, it is as nutritious as most common milling varieties and it is suitable for animal feed as well. As for all organic wheat, it is difficult to standardise a bread-making process, and it is more relevant to know the flour and build the processing on this knowledge. That is what some innovative bakers have done, with tasting of products available at NOCC 2017 (see opposite).

How do I get it?

Contact: crops@organicresearchcentre.com

Baking the story

ORC Wakelyns Population flour is giving a Nottinghamshire baker a unique chance to strengthen relationships across the supply chain and produce a more sustainable loaf of bread.

Thanks to her links with BBC Food and Farming nominees, Hodmedod's, Kimberley Bell of the Small Food Bakery in Nottingham is using flour from the Organic Research Centre's

Wakelyns Population wheat to bake a very special variety of sourdough bread. Now ORC is working with Kimberley to find out how easy the crop's resulting flour is to bake with, and whether it results in a tasty loaf which has a strong story to tell consumers about how their bread was produced.

"I started using the Wakelyns flour after Hodmedod's sent me a bag," says Kimberley. "When I tried it I realised that it might be an interesting type of grain from its flavour, so I asked Hodmedod's what it was, and that's when I discovered its incredible story."

For Kimberley, aside from the flavour, the flour from the Wakelyns Population connects heavily with her bakery's ethos to produce better-tasting food which is not only more sustainable for the environment, but has strong links to primary producers. By ensuring her farmer suppliers are given fairer prices for their produce, Kimberley wants to help shorten supply chains and build relationships with growers so that her customers can get a better understanding of where their food comes from.

"The Wakelyns wheat has the most incredible set of credentials," she adds. "People often argue that wheat production can never be sustainable, but the Wakelyns wheat seems to be part of the solution to our environmental problems of mono-cropping and using so many inputs.

"Our customers have been really interested in the story behind it too, and anything which helps connect people to their food is fantastic."

(Source: OF&G)



Kimberley Bell offers samples of sourdough bread and cookies made with ORC Wakelyns Population flour to delegates at NOCC 2017