

What have they done to the grain?

by Andrew Whitley

How could it be that wheat, the staple crop of our civilisation, seems to be making increasing numbers of people ill? The statistics on this are, not surprisingly, a little hard to pin down but somewhere between 65,000 and 900,000 people – depending on which scientists you believe - may have an adverse reaction to wheat. This is quite separate from the very specific Coeliac disease which is a serious reaction to gluten and is said to affect 0.3% of the population or around 150,000 people.

Since bread is the main way we consume wheat and gluten, bread it is that more and more people are giving up.

Wheat and Evolution

It seems likely that humans started eating cereals in large quantities when they discovered between 7,000 and 12,000 years ago (in different parts of the world) that the seeds of wild grasses could be stored for use over a long period and that these seeds could be sown deliberately to create a convenient and abundant crop. Gradually selection would have improved the productivity and palatability of the grains.

10,000 years is, in evolutionary terms, a mere heartbeat. So we haven't had long to get used to eating cereals. The fact that Coeliac disease is inherited suggests that some people have adapted less well than others to the 'new' human diet of cereals. But studies have shown that relatives of coeliacs, though showing no signs of disease under normal conditions, suffered more than 'ordinary' people when given very large amounts of wheat protein. Natural selection, which would normally iron out such differences, simply has not had enough time to complete the process and now, of course, never will.

So, many people may be mildly affected by the natural defensive chemicals found in wheat.

Wheat Hybridisation

Once Mendel had revealed some of the keys to plant genetics, farmers and agronomists had the means to speed up what until then would have been a very gradual process of selection. Chance cross pollination would have led to occasional variations in plants and observant farmers would have selected these specimens for further replication.

The advent of synthetic chemicals in agriculture and the deployment of ever more sophisticated fast-track techniques for forcing mutations or variations in plants, transformed things in various ways.

Yield has always been important, but in the post-World War 2 climate of agricultural intensification, it became paramount. Wheat varieties were developed which responded to heavy applications of soluble nitrogen, potash and phosphorus. But such a regime produces a flabby straw that falls over in wind or rain. So wheats with short straw were developed.

Once hooked on their fix of soluble chemicals, the new varieties showed signs of succumbing more than before to fungal and pest attack. So new strains were bred with built-in resistance.

Yield, short straw, disease resistance, milling quality...the plant breeders have readily obliged. They have done so, to date, without recourse to GM technology, though that is in the wings.

What is striking in all this – for those of us who think that farming has something to do with feeding healthy people – is that nutritional quality doesn't get a look in. No-one seems to be asking whether, as new variety succeeds new variety with bewildering speed, wheat is getting better or worse to eat.

Might it be that, by failing to include nutritional quality in our wheat breeding criteria, we are unwittingly exacerbating an imperfect human adaptation to this staple, but relatively novel, food?

Yeast

Before the mass production of compressed yeast (which is grown on a substrate of sugar beet molasses) it was either unavailable or expensive. Bakers had to eke out whatever leavening or raising agent they had. A typical traditional breadmaking cycle would take between 16 and 24 hours.

Modern breadmaking, by contrast, with the Chorleywood Bread Process (CBP) which uses a combination of mechanical kneading and chemical oxidants to make dough out of relatively low protein wheat, can turn flour and water into a sliced, wrapped loaf in about 3 hours.

But, whereas the typical breadmaking systems of the 1930s used around 0.5% yeast, the CBP calls for 1.75-2% yeast, to get the bread to rise fast. That's roughly a fourfold increase in yeast levels.

This CBP has been tested on the UK population for the last 40 years. And now we find that more and more people are 'intolerant' to yeast. What a surprise!

We don't *know* whether there is a causal connection here – whether, for instance, partially baked residues of bakers' yeast in standard bread pave the way for invasive organisms like *Candida Albicans*. It would be well worth finding out.

Enzymes

So – we've bred highly functional wheats that may disagree with us, and we've quadrupled yeast levels and radically speeded up the fermentation process.

What else could we possibly do to the poor old staff of life? Patch it up with a few enzymes, perhaps?

Enzymes are added to flour by millers or at the doughmaking stage. During the baking process, enzymes transform the components of the flour thus:

- Starch and proteins are degraded into yeast foods
- Gums are transformed into small fragments, enabling the dough to hold more gas (and therefore rise higher)
- Lipids are hydrolysed into mono- or diglycerides which act as emulsifiers, boosting loaf volume and increasing crumb softness

The enzymes used in breadmaking are derived from substances including:

- *Aspergillus niger*
- *Aspergillus oryzae*
- *Bacillus amyloliquefaciens*
- Soybeans
- Wheat
- *Trichoderma longibrachiatum*
- Pig pancreas

Increasing numbers of commercial enzymes are derived from genetic engineering. In theory, enzymes are destroyed by the heat of baking. That's why this particular form of addition doesn't have to be declared on the label: enzymes are treated as processing aids, not additives. However, much effort has gone into the development of thermostable preparations that survive the baking process and have a residual crumb-softening effect. That such enzymes should still be treated as processing aids and therefore exempt from labelling is a regulatory oddity that would seem to be in the interests more of the industry than the consumer.

Amylases are known to cause allergic reactions in some people. There is an occupational health risk to bakery workers if enzymes get into the atmosphere, where they can be breathed in and can cause asthma. But research in the university of Bochum in Germany has shown that up to 20% of the allergenicity of fungal alpha-amylase can survive in the crusts of bread.

Perhaps we should revise the old adage about eating up your crusts: maybe they do more than just make your hair curl!

Not all bread has enzymes added. Genuine artisan bakers, especially on the Continent, make wonderful bread without them. Which may explain why some people who cannot eat British bread have no such difficulty abroad. One person with what was thought to be a wheat intolerance, having enjoyed French bread while on holiday, sought out 'bread made with French flour' upon her return. But

she reacted immediately with the same symptoms of bloating and discomfort that had previously afflicted her. Had the French flour had changed as it crossed the Channel? Or had the British bakery slipped in some enzyme 'improvers' – without, of course, bothering to mention the fact on the label?

The staff of life, then, turns out to be a pretty questionable support – made with wheat that's been bred to do all sorts of things except nourish us, puffed up with much more yeast than it used to be, laced with additives that suit the commercial purposes of millers, bakers and shopkeepers, but maybe don't do some of us much good.

What Should be Done?

We need urgent research into the nutritional properties of wheat in order to establish which micro-toxins are responsible for provoking allergic or intolerant reactions.

Then we need to feed this knowledge into the wheat breeding programme in order to produce new varieties which are both more nutritious and more palatable.

At the same time, we should develop wheat varieties – probably based on older original strains – that are more suitable for organic agriculture.

With all processing methods, including the use of yeasts and enzymes, we should take a precautionary approach, bringing nutritional integrity into play as a key criterion and basing product development and innovation on more rational grounds than supermarket pressure.

Let's enjoy our bread fresh (in the proper sense of the word), respect it as it ages and remember it as something life-enhancing and sustaining, not reduced to the status of an allergen, despised and undervalued even as we read the health warnings on the label.