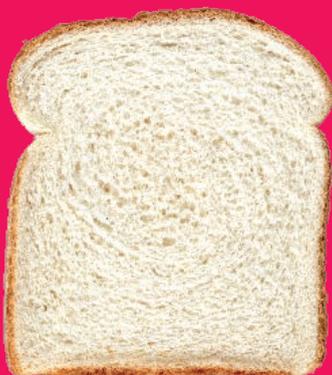




**A NEW
KIND OF
SUPERFOOD**



From good-gluten bread to healthier oils, a new wave of healthier foods are on the way. The catch? They're GM. Michael Le Page reports

PAUSE a moment the next time you are munching on French fries in a restaurant. How would you feel if someone told you those fries are healthier than normal thanks to the oil they were cooked in? Now, what if the reason they are better for you is because this oil comes from genetically modified plants?

GM foods have been around for decades, but there has been no reason for consumers to be keen on them. Virtually every GM crop on the market is designed to help the farmer who grows it rather than the person who eats it. Now that's starting to change.

The next generation of GM foods comes with added health or flavour benefits. Some are already in the shops and on our plates, and others will be soon. On the menu are a coeliac-friendly wheat that contains only "good" gluten, potatoes that don't produce harmful acrylamides when fried, rapeseed oil rich in beneficial omega-3, higher fibre white bread and more.

It is healthier cooking oils that are already being produced in the biggest quantities, though. Millions will soon be eating them, including people in Europe, where GM foods are widely shunned. But what is really extraordinary is that despite their benefits, no one plans to tell you about them.

The first ever GM food to go on sale, the Flavr Savr tomato – launched in 1994 – was designed to stay fresh for longer. This meant it could be picked after ripening and thus tasted better than normal supermarket tomatoes, which are picked green and ripened artificially at the expense of flavour. But it was discontinued after three years because it wasn't profitable.

Other GM crops have thrived, however. Most of the soya grown globally, and more

than a quarter of maize and oilseed rape, is now GM. In some countries, such as the US, most processed foods contain at least one ingredient, for example corn syrup, derived from GM crops.

These crops typically have traits whose benefits, such as insect or herbicide resistance, are obvious only to farmers. But in the past few years this has started to change, with foods arriving that offer added perks for consumers.

Fresher for longer

The Innate potato, for instance, is less prone to bruising and resulting black spots, and produces less of the potentially dangerous chemical acrylamide when fried than conventional potatoes. It has been sold as White Russet in the US since 2015.

Then there are apples that will appeal to those people – especially kids – who don't like eating fruit that has gone brown after being sliced. Arctic apples, which never discolour, went on sale in the US in November 2017.

So far, these products are being produced in relatively small quantities. But the next GM superfood to make its way on to our plates – or into our takeaway boxes – is going to be huge.

Soybean oil is incredibly popular, especially in the catering industry. Yet it's not actually ideal for cooking. The raw oil consists of around 60 per cent polyunsaturated fats, which are unstable. These limit the oil's shelf life and break down when used for frying to form bad-tasting and harmful byproducts.

By contrast, monounsaturated fats like oleic acid, found in olive oil, are more stable and thus better for cooking. But olive oil, which is up to 80 per cent oleic acid, is expensive.

So, back in the 1950s, producers started ➤

Fats with benefits

Soon, we are all likely to be eating a new kind of healthier, genetically modified oil. So what's different about it?

For starters, high-oleic soya oil contains none of the harmful trans fats found in conventional hydrogenated soya oil. There is no doubt that removing these from food is beneficial, says Marianne Jakobsen of Denmark's National Food Institute.

High-oleic oils are also much less likely to break down into aldehydes when used for cooking – and these are even more toxic than trans fats.

A third plus is that the oils contain less saturated fat, so should reduce the risk of heart disease, although the idea that saturated fats are bad for us has been questioned of late.

And a study last year found that when mice were put on a very high fat diet, those fed high-oleic soya oil instead of normal soya oil were less likely to become obese or get diabetes – although it's not yet clear why, nor if these findings are relevant to people.

This does not mean that gorging on fast food fried in high-oleic oils is good for you, of course, just that it is less bad than stuffing your face with foods fried in hydrogenated polyunsaturated oils. "It always depends on what you compare with," says Jakobsen.

Superfoods à la GM

Non-browning apples

Some people dislike eating fruit with flesh that has become discoloured. This never happens to Arctic apples. They went on sale in the US in November 2017.

Potatoes that don't bruise

The Innate potato is less prone to bruising and consequent black spots. When fried, it also produces less acrylamide, a substance suspected of causing cancer, than conventional spuds do.

Wheat with "good" gluten

People with coeliac disease could soon have their cake and eat it. At least two groups worldwide are editing out the genes for the gluten proteins that damage the guts of people with this digestive disorder. One GM wheat is undergoing clinical trials in Spain.

Pink pineapples

They are pink because they accumulate lycopene, the pigment that makes tomatoes red, instead of

converting it into yellow beta-carotene as normal pineapples do. The US gave the green light for this variety to be eaten in December 2016, but it is yet to go on sale.

Lycopene is thought to have various health benefits. The pink pineapples are also said to be sweeter – and add a twist to a pina coloda.

Omega-3 rapeseed (canola)

This seed from the rape plant is rich in the beneficial omega-3 oil DHA. The plan is to market it first as fish feed and then for human consumption. Last year, 1200 hectares were grown and harvested in the US.

High-fibre white bread

Gene-edited wheat yields white flour with three times as much dietary fibre as standard white flour.

Bloodier oranges

Blood oranges are regarded as beneficial because they are rich in antioxidants called anthocyanins. Normal blood oranges only turn red if



ARTIST'S IMPRESSION; SHUTTERSTOCK

taking cheap-as-chips soya oil and hydrogenating it, a chemical process that makes it more stable. By the mid-1960s, more than half the cooking oil sold in the US was hydrogenated soybean oil. Today, it is the second most widely used vegetable oil in the world after palm oil.

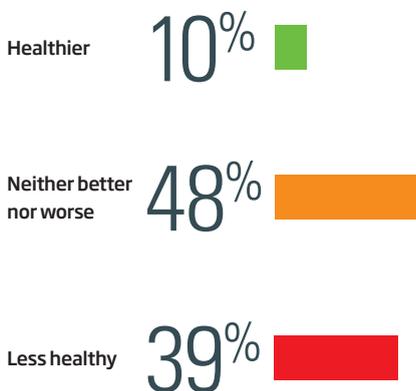
Hydrogenation solved the cooking problem, but it has a serious health downside: it causes trans-fatty acids, or trans fats, to form. By the 1990s, it was becoming clear that these greatly increase the risk of heart attacks and strokes. In 2003, Denmark became the first country to ban them.

So for decades companies have been working to produce cheap, trans-fat-free oils by altering crops so their oil contains more oleic acid. Two US firms have created genetically engineered strains of soya that are high in oleic acid: Monsanto with one called Vistive Gold and DuPont Pioneer with Plenish. Their oils are more than 70 per cent oleic acid – similar to the amount in olive oil.

Still, these oils remained a niche product until 2015, when the US Food and Drug

Unhealthy attitude

Few people in the US believe GM foods can be better for their health than non-GM foods



SOURCE: PEW RESEARCH CENTER (2016)

Administration ruled that trans fats had to be phased out of all foods by June this year.

"We realised that this trans-fat ban was going to make big changes in the food industry," says Federico Tripodi, head of Minnesota-based company Calyxt, which has developed a high-oleic soybean using gene editing.

As well as being boosted by the ban, production of high-oleic soya is expected to soar because Plenish and Vistive Gold got full approval in the past year in all major export markets, including China, Australia, New Zealand and the European Union.

"The soybean industry estimate the long-term market potential for high-oleic soybeans is 15 million to 20 million acres," says David Tegeder of DuPont Pioneer. That would make them one of most widely grown crops in the US – and would mean that many millions of people around the world will be consuming their oils.

And that's good news. Swapping conventional hydrogenated soya oil for the high-oleic form will improve people's health in

they experience cold nights while growing. The GM strain is full of anthocyanins regardless of the weather. The oranges are not yet on sale.

Bananas with a boost

The matoke cooking banana is a staple in Uganda. The GM variety contains provitamin A, a lack of which can lead to blindness. It is being field tested in Uganda and could be on sale in 2021.

Lower-saturated fat rapeseed oil

Conventional rapeseed oil contains 7 per cent saturated fats. A gene-edited variety will have half this amount.

Golden rice

Rice designed to reduce vitamin A deficiency has been under development for decades, but has yet to reach market. It received a big boost earlier this year when Australia, New Zealand and Canada declared it safe for humans, meaning there would be no regulatory issues if those countries imported food containing small quantities of the rice.

several ways (see “Fats with benefits”, page 29).

You might expect, then, that the companies behind these products would be keen to extol their virtues to consumers, especially in light of the long campaign waged against GM foods. Far from it.

New Scientist asked Calyxt, Monsanto and DuPont Pioneer whether they would be advertising the benefits of high-oleic oil directly to shoppers, and whether they saw these products as an opportunity to highlight the fact that genetic modification can benefit consumers. None said they would be doing either of these.

DuPont Pioneer said it will be focusing on the companies that process soybeans and sell the oil to restaurants and other parts of the food industry. Calyxt said much the same. Monsanto did not respond to several requests for comment.

That means local labelling laws will determine whether consumers can tell if they are buying or eating food containing these oils (See “Food rules”, overleaf).

Restaurants – especially fast-food ones – are

likely to embrace them. As well as complying with the trans-fats ban in the US, high-oleic soya oils have an extended shelf life compared with conventional oils and can be used in fryers for longer before they need changing.

Yet restaurants have little to gain from advertising the switchover, given that many people remain opposed to GM. It is therefore unlikely that most consumers in the US will find out what their fries are being fried in. The same is true in Australia and New Zealand, where laws requiring most GM foods to be labelled exclude those sold to be eaten immediately, as in restaurants.

Both Plenish and Vistive Gold have been approved in the EU, where GM food has to be labelled on menus, but even there consumers are likely to remain none the wiser. Anti-GM campaigners say many restaurants already routinely use GM cooking oil without declaring it.

Good gluten

“I’m sure it’s happening,” says Liz O’Neill of GM Freeze, an anti-GM group that monitors what GM foods are sold in the UK. “We have a lot of anecdotal evidence.”

No official checks are done, she says, but when volunteers have looked through the rubbish discarded by restaurants that don’t say they use GM oil they have often found empty containers. It’s not necessarily a deliberate attempt to deceive – small fast food outlets may not be reading the small print when they buy oil in bulk.

What about your shopping basket? GM foods don’t have to be labelled in the US, so most people probably have no idea that the White Russet potatoes or Arctic apples they buy are genetically modified. In fact, a 2013 survey found that half of people in the US did not even know if supermarkets sold any GM foods.

By the time good-gluten sandwiches are on the menu (see “Superfoods à la GM,” above left), things could be different. From July, a new US labelling law means that, at the very least, firms must add a scannable barcode to any food containing GM ingredients (see “Food rules”, overleaf). However, the draft rules were unveiled only in May, and it appears that food made from gene-edited crops will not have to be labelled.

The argument here is that varieties of plant created by altering their own genes, rather than by adding extra genes sometimes taken from other organisms, are distinct from normal GM crops. US regulators appear to agree. For instance, they have

Why the worry with GM?

The idea of GM food horrifies some people. “It’s the yuck factor,” says writer Mark Lynas, who used to destroy GM crops as an activist but now supports their use.

People are repelled by the idea of transferring DNA from one species to another, he says. All the other issues are secondary. “It’s the transgenic aspect. The defilement of the sacred boundaries between species.”

We now know there are no sacred boundaries. Not only does all life on Earth share a lot of genes, but viruses and bacteria can also move bits of DNA between species, creating natural transgenic organisms. For instance, the monarch butterfly has bits of wasp DNA in its genome.

But being natural doesn’t in itself make something right or wrong. Here Lynas cites Denis Gonsalves, the creator of GM papaya grown in Hawaii. “If you are telling me that you think it is wrong to move a gene between species, that is your belief and I respect that. If you are telling me that it is dangerous, that is a question that can be resolved by science.”

Although most people in Europe think GM foods are not safe to eat, there is no reliable evidence that any existing GM food is less safe than conventional food. In theory, new GM crops might have, say, higher toxin levels, but this should be picked up by safety tests.

Many other objections to GM crops relate to particular traits. For instance, one claim is that the introduction of herbicide-resistant GM crops led to a massive rise in herbicide use and is thus damaging the environment. But actually herbicide use fell, says a 2016 report from the US National Academy of Sciences. What’s more, companies are now creating herbicide-resistant crops by conventional breeding, so it is no longer GM-specific.

There is also concern that modified genes are spreading “uncontrollably”. There is no doubt that some GM crops are interbreeding with wild relatives. But there’s no reason to think this will create monsters – herbicide resistance, say, doesn’t help plants in the wild.

For some, the problem has to do with modern farming rather than GM technology. “My concern about GM crops is that they are being used very poorly right now, and without larger social and environmental consequences in mind,” says Jon Foley of the California Academy of Sciences. “Plus, their use is largely driven by profit, which makes me nervous.”

Food rules

European Union

In principle EU laws introduced in 2003 should have allowed GM crops to be widely grown and eaten. But in practice only one crop is cultivated commercially – in Spain – and after a rule change in 2015, most member states banned their cultivation outright.

Approved foods can be imported and sold, but must be labelled if the GM ingredient makes up more than 0.9 per cent. Because of this requirement and public opposition, few foods with genetically modified ingredients are sold in shops or restaurants. But large quantities of GM animal feed are imported.

US

GM crops are widely grown. Almost all the maize and soya is genetically engineered, as well as numerous other crops from potatoes to papaya. Supermarket shelves, too, are full of GM foods.

After considerable public opposition to such foods and a long-running battle for labelling, a law coming into force in July will require foods with GM ingredients to say so in words, pictures or with a scannable barcode.

Australia and New Zealand

Several types of GM rape plant are grown and many foods contain imported genetically modified ingredients. Only some GM foods have to be labelled. For instance, refined products like oils and sugars that are free from any modified protein are exempt, as are foods sold in restaurants.

Elsewhere

Regulations vary wildly, ranging from zero tolerance in Zimbabwe and Zambia to minimal restrictions in Hong Kong.



Arctic apples, which went on sale in the US in November 2017, never go brown

told Calyxt that its products, such as the high-fibre wheat, and its good-gluten flour – which is made by slicing out the genes that make the kind of gluten implicated in coeliac disease – will be treated as conventional rather than GM foods.

The EU is still vacillating. If it follows the US example, though, most gene-edited foods would not have to be labelled. So it is possible people could end up eating these foods without being aware that they have been created by a form of genetic modification.

“The consumer has to have a choice. And they have to be informed to make it”

“We think it’s important that consumers do have the choice,” says Helen Wallace of the campaign group GeneWatch UK.

And it’s not just opponents of GM crops who regard this as desirable. “My view is that you should label,” says Johnathan Napier of Rothamsted Research in the UK, who develops GM crops and also advocates for their use. “The consumer has to have a choice. And you really want the consumer to be informed when they make that choice.”

Yet even if GM foods that benefits the consumer are clearly labelled and marketed as being modified, there is no guarantee this will change attitudes (see “Why the worry

with GM?”, page 31). “I think it’s going to be difficult to change people’s minds,” says writer and environmentalist Mark Lynas, an anti-GM campaigner turned supporter. In fact, the potential of these consumer-friendly goods to sway public opinion could trigger a huge backlash from opponents. “Any GM organism that can do good is actually seen as a greater threat,” he says.

Take the efforts to enrich rice to prevent vitamin A deficiency, which causes blindness and even death. Golden Rice, as the vitamin-enriched GM version is called, promises to improve the lives of millions of children, yet anti-GM organisations have fervently opposed it.

The stakes are high. GM crops could help us produce better foods in a more environmentally friendly way, which will be ever more important as the population grows and the planet warms. For instance, Napier is developing crops rich in beneficial omega-3 oils. As these oils typically come from wild fish caught to feed farmed fish, this could make fish farming more sustainable as well as having health benefits.

The arrival of a generation of GM crops with clear benefits for consumers should be big news. But far from helping to win over hearts and minds, it seems few people will even realise what they are eating. Plus ça change. ■

Michael Le Page is a senior news reporter for *New Scientist*