foodunfolded®

Rediscover the origins of your food

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"Knowing more about our food and its origins, can deeply impact our food choices, and ultimately, our planet."

Dear Reader,

What do you enjoy eating most?

If you asked me this question, I wouldn't know where to start. There's so many wonderful food and drinks to choose from, that I'm not quite sure I'd be able to classify any one meal or food as a favourite.

Now if you asked me: *Do you know the origins of your food?* I'd be equally tongue-tied.

Fact of the matter is, most of us see the food on our plate without really knowing its story. We might know the cook or which grocery store or restaurant we purchased it from. Occasionally, we might know who grew our food (if you're lucky enough to have family friends who grow the sweetest cherry tomatoes you've ever tasted), but more often than not, we don't really know where or how our food was grown, the unique individuals involved in the process, or even the impact our food has on the environment.

And yet, the growing global concerns of issues like welfare, health and climate change are so intimately entwined with our food production that we can sometimes forget how our food choices and consumption affect the direction of our food's production. While knowing more about our food and its origins, can deeply impact our food choices, and ultimately, our planet.

It's a big statement, I know, and sometimes intimidating to consider. But, it can also be incredibly interesting and enlightening to discover the story behind our food and tech that makes our food more sustainable and healthy—ideas and innovations that we might have never even thought of!

I hope that you'll carry this curiosity while flipping through our FoodUnfolded magazine. The articles and infographics you'll find in these pages are a few of our favourite pieces selected from our website, and the recipes you might try were crafted by passionate chefs and foodies.

We've put a lot of heart, soul and research into our content, wrapping together expert interviews, scientific studies and passion within these pages. We hope wherever you're reading this, you enjoy rediscovering the origins of your food.

Bon Appétit,

Jane

Editor

Gignōskō
TO KNOW

Ón Fharraige
FROM THE SEA

茶 Chá
TEA

Erþō
EARTH

Búkr
BUG

Custos
GUARDIAN

Gignṓskō

γιγνώσκω

Ancient Greek meaning '**to know**' and '**to become aware**'. We all eat and drink, but do we really know where our food comes from? How it's made? The science behind certain foods? Begin your journey to know.

PHOTOGRAPH: KIRSTYN BYRNE

MARIE LÖDIGE

When Honey is Good and Ready

Most of us enjoy honey and know the basics of the production. The bees produce the honey in their colonies, beekeepers take the honey (in their fancy suits) and centrifuge it to get to the sweet goodness.

Turns out there is more to producing honey, especially in Germany. You might know that we Germans (I'm German, just FYI) love our guidelines and rules, so it comes as no surprise that we also have them for honey.

In Germany, there is a honey directive (HonigV) that regulates honey and its content, like how much water is allowed to be present. The 'German Beekeeper Association' has even stricter regulations, and only by sticking to their regulations can beekeepers label their honey as "real German honey". For example, the water content of honey is one of the factors regulated.

BUT WHY IS THE WATER CONTENT OF HONEY SO IMPORTANT?

We've all heard the rumour at some point, that honey can't go bad. Well, it actually can. If the water content is too high the water can allow conditions for yeast to grow and then the honey will start fermenting. Quite frankly, fermented honey does not sound that appetizing.

In the "HonigV", the maximum water content is 20% for most types of honey. Only "Heather Honey" can have 23%. To get the "Real German Honey" seal these numbers are a bit lower with a maximum of 18% of water (preferably between 15-18%).

If the water content is under 15%, the honey might not reach its fine crystalized structure and might become too hard. And, a honey that is too hard does not achieve its full aromatic potential.

The humidity, more often than not, dep-ends on if the honey is ripe or not. The ripeness of the honey can be identified in a few different ways, one is the refractometer (explained later).

Other methods include a 'splash' test. Does the honey splash out of the open combs when compressed and held horizontally? If yes, then it is not ripe yet. Of course, this is not the most accurate test though.

Another sign of ripe honey is if the bees have already sealed 2/3 of the honeycomb with a thin layer of wax. Again, not the most accurate sign, because they can start sealing earlier, meaning the honey can still be over 18% humidity.

SO, WHAT'S A REFRACTOMETER?

Measuring the water content of honey with a hand-held refractometer is a bit of an art itself.

A refractometer is based on how light is refracted in a liquid. Essentially, it's like a tiny microscope. A dot of honey is wiped onto a glass plate, covering the entire plate. It is then angled towards the light. Inside the refractometer is a scale (often blue), and the light that is reflected by the honey will turn part of the scale white, creating a line that shows the water content. A beekeeper needs to make sure that he or she tests honey samples from both the middle of the comb and the outside to ensure an even water content.

An important note is that the honey should be clear. If it is not clear, it needs to be heated until it becomes clear. Otherwise the light wouldn't be broken properly. If the moisture is right, the combs are ready to be centrifuged to sweep the honey out of the combs.

BONUS FACTS

But, it is not only the water content that allows a honey made in Germany the seal of approval by the German Beekeeper Association. Fructose and glucose content, saccharose content and many more factors are also important. And let's not forget that honey is distinguished by the flower bees use as their source (e.g. rapeseed honey must have a certain percentage of pollen from the rapeseed plant).

So, honey in Germany is surrounded by a lot of rules and regulations (like everything else too). Do you think it's worth it?

For the full article with references, see foodunfolded.co/honey.

"Another sign of ripe honey is if the bees have already sealed ⅔ of the honeycomb with a thin layer of wax."

LOTTIE BINGHAM

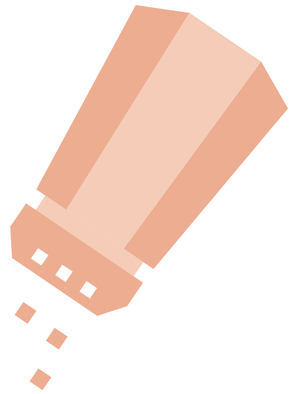
The Science Behind Salt

For most of us, food can be bland without salt. But salt wasn't always used for flavour. How did it come to be added to food in the first place, and what is it doing to our health now?

Today we sprinkle it on popcorn, stir it into sauce, or grind it onto a plate of pasta, but this readily available and cheap-as-chips seasoning was once more revered. Table salt—the white isometric crystals found on almost every kitchen table, in every restaurant, in pretty much every single meal in the world—was once described by Plato as being especially dear to the gods, whilst Homer referred to it as 'the divine substance'.

SALT, THE FIFTH TASTE

There are numerous reasons for adding salt to food. Nowadays, the most common reason comes down to its unique ability to enhance the flavours of almost any food. It both enhances the pleasurable aspects of enjoyable ingredients, whilst masking certain flavours of otherwise bitter or unpalatable foods. In both ways, salt quite literally makes food taste better.



The effect is not, however, infinite. This is because salt not only has the capacity to enhance the positive sensory attributes of other ingredients, but it also imparts a taste of its own. There are five primary taste sensations: sour, sweet, bitter, umami, and salty. Sodium Chloride, the prototypical salt, has an almost pure 'salt' taste, the intensity of which increases with rising concentrations. There is a point at which this rising 'saltiness' tips from adding to the level of hedonic pleasure derived from a salty snack to decreasing the palatability of food. This optimum level of salt (often referred to as the 'bliss point') does not have a set value, but rather depends on the other ingredients present, as well as on the individual consuming the food—with the bliss point varying from person to person depending on their previous salt exposure.

HOW SALT PRESERVES FOOD

Whist its sensory attributes are powerful, and undeniably the most dominant reason for its use in modern cuisine, historically, preservation was the main culinary use of salt.

Salt is an effective preservative for many reasons: it binds to water, reducing the amount available for microbial growth and chemical reactions. It can also induce something called osmotic shock–a process which sees extensive water being lost from the microbial cell, leading either to slowing of growth or even cell death.

Today, although rarely utilised as the sole method of preservation, it is still frequently relied on in combination with other additives and/or techniques to create an environment that is highly resistant to spoilage.

HOW SALT FERMENTS

Another salt-dependent culinary trend, currently experiencing an unprecedented rise in popularity, is fermentation. Despite constituting another form of food preservation–fermentation relies on the presence, as opposed to the absence, of microbes. During the fermentation process, salt (in the form of brine), inhibits the growth of spoiling bacteria and fungi, but promotes the growth of the more salt-resistant lactic-acid bacteria (LAB). LAB convert energy from food sugars and starches into lactic acid which, by lowering the pH of the brine, acts as a natural preservative, as well as accounting for the deliciously tangy flavour characteristic of fermented foods.

This process is further helped by the salt drawing water and sugars out of the plant tissues, making them more readily available to the LAB, increasing the rate at which they can convert cabbage into sauerkraut, cucumbers into pickles and milk into yogurts and cheese.

"This optimum level of salt (often referred to as the 'bliss point') does not have a set value, but rather depends on the other ingredients present."

TOO MUCH SALT & HEALTH PROBLEMS

Salt—or more specifically, the sodium component of salt—is essential for the proper functioning of our body. It is, amongst other things, necessary for the firing of nerve cells, in the contraction of muscle fibres and in the maintenance fluid balance.

That being said, we need only small amounts for the healthy functioning of the body. Although the absolute minimum is not yet well-defined, it is thought to be in the range of 200-500mg per day of sodium (or 0.5-1.25g salt).

Today, with the prevalence of pre-prepared and processed foods, which heavily rely on salt's capacity to both increase shelf life and improve taste, one has to almost actively try to be sodium deficient. Whilst being low in sodium can have severe consequences, so too can having too much.

High sodium intake has been linked to increased blood pressure (BP) and cardiovascular disease (CVD). There is, however, a less widely discussed but growing body of evidence which implicates high salt consumption with a whole host of systemic problems, from osteoporosis to headaches. Of these impacts, perhaps the most alarming is the potential for salt to promote cancer, most notably gastric and renal cell cancers.

Despite the necessary intake being so low, the average daily global intake is close to 9.75g of salt per day. It should come as no surprise, therefore, to hear that the World Health Organisation (WHO) recommends that all member states implement a salt reduction program. Astonishingly, if global intake of salt were brought down to within the recommended levels, an estimated 2.5 million deaths could be prevented every year.

TAKE IT WITH A GRAIN OF SALT

Quite literally. A small amount of sodium is necessary for our health but try not to go overboard. Rather than opting for a high-sodium ready meal, try to get your sodium from a less processed (gut-friendly) fermented food, like sauerkraut. I myself am rather partial to a healthy serving of sauerkraut.

For the full article with references, see foodunfolded.co/scienceofsalt.

CLAUDIA PARMS

Explaining Low-Fat Foods

What does low-fat mean? How is fat removed from yoghurt and what is the impact on its nutritional value? Let's dig into these questions and find out.

WHAT DOES LOW-FAT MEAN?

Food manufacturers like to use claims to point out the nutritional benefits of their products. One such claim is "low-fat". However, manufacturers are not allowed to stick just any label on their products. As a rule of thumb, a product can only be labelled as "low-fat" if it contains less than 3g of fat per 100g for solid foods. For liquids, this is 1.5g of fat per 100ml.

HOW ARE MANUFACTURERS MAKING LOW-FAT YOGHURT?

Yoghurt has the same percentage of fat as the milk used to make it. This means that the traditional whole milk yoghurt is higher in fat than yoghurt made with skim or low-fat milk. So, the choice of milk is how manufacturers reduce fat grams in yoghurt. On the other hand, fat plays an important part in the tastefulness of food. Plain yoghurt has a rich taste to it, whereas yoghurt made with low-fat milk will have a less pleasant taste.

To make up for the lack of flavour by the elimination of fats, manufacturers use different ingredients (like fruit, corn syrup, artificial sweeteners etc.) to improve the tastiness. Moreover, to increase yoghurt's shelf life and to make it look more delicious, preservatives and food colourings are often added. To improve the texture of low-fat yoghurt, manufacturers also add thickeners like gelatine, gum, or starch.

IS THE TRADE-OFF WORTH IT?

While many researchers are still studying the full-fat dairy paradox, we know that fats give food products its flavour and texture. So, by removing fats manufacturers are burdened with the challenge to create high-quality reduced-fat food products. In the end, more sugar and sweeteners are added to the product to make up for the taste (even though the calorie amount in the end-product may be lower than the full-fat alternative!).

But don't forget, your body also needs fats, and fats in yoghurt can be good for you. Even if you follow a low-fat diet you may want to consider removing fats from your diet elsewhere, like by eating more foods that are naturally low in fat.

For the full article and references, see foodunfolded.co/lowfatyoghurt.

KELLY OAKES

The Science of Fermentation

Fermented foods like kombucha and kimchi are becoming more and more popular – but what does fermentation actually involve?

WHAT IS FERMENTATION?

Fermentation is a process that many foods go through before they reach our shelves and refrigerators, including bread, cheese, wine, yoghurt, and even coffee. It happens when microbes or enzymes start breaking down carbohydrates, like sugars.

THE SCIENCE BEHIND FERMENTATION

From Korean kimchi to German sauerkraut, different cultures have their own specialised recipes for fermented foods. But each time the basic principle is the same: allowing certain kinds of helpful microorganisms to break down carbohydrates in the food and create acids or alcohol, making an environment that's hostile to harmful microorganisms.

Bacteria, yeasts, and moulds can all be involved in fermentation. While it might seem counterintuitive to encourage bacteria to grow on food, there's a huge diversity of microbes out there, and some of them count as "good" bacteria that help rather than hurt us.

In fruits and vegetables, the most important bacteria involved in the fermentation process is lactobacillaceae, which breaks down carbohydrates to form lactic acid. Sauerkraut, kimchi, and some other pickles get their sour, tangy taste from this acid. But it doesn't just affect taste: the acidic environment is what preserves the food and prevents harmful bacteria from growing.

For the full article, see foodunfolded.co/fermentedfoods

ANNABEL SLATER

The Art & Science of Sourdough Bread

Today, sourdough is considered an artisanal bread, but 160 years ago nearly all bread was sourdough. What changed?

HISTORY RISES AGAIN

No one knows who made the world's first raised bread. But it's likely to have happened after humans invented agriculture. Settling in one place, experimenting with mixtures of grain, someone probably noticed a mixture of crushed grains and water forming bubbles after a few days—the tell-tale sign of fermentation. Here's what we know

FROM FERMENTATION TO SOURDOUGH

Fermentation occurs when microbes (like bacteria and yeast) digest substances, producing gas and other products. Milled flour naturally contains strains of *Lactobacillus* bacteria and wild yeast from the environment, and these microbes can digest starches and sugars in the flour. Ancient civilisations would have found out that this frothy mixture, when baked, produces a softer and fluffier alternative to early flat breads. This began the trend of 'leavening' bread, making bread rise by incorporating substances (like microbes) to put gas bubbles in the mixture.

Does this process sound familiar? It's actually how sourdough is traditionally made! So ancient leavened bread was just sourdough. Sourdough was eaten by the ancient Egyptians, taken to Northern America by French bakers during the Gold Rush, and nurtured in bakeries across Europe.

So what changed? Eventually bakers figured out that it was yeast that did the bulk of the leavening–adding yeast to a dough mixture gave fast and reliable results. In 1857, French microbiologist Louis Pasteur identified yeast under the microscope, which led to the creation of commercial baker's yeast. Bread production was transformed, and sourdough was no longer the only option.

> FUN FACT:
> *For a while, bakers used brewer's yeast which gave the bread a bitter flavour.*

"In Sweden, a sourdough hotel will maintain your starter for you while you're on holiday."

WHAT'S IN A SOURDOUGH?

But *Lactobacillus* and yeast don't just change the texture of bread, they change its chemistry. Raw sourdough is a living thing, a changing blend of microbes, and it's the natural balance between the yeast and bacteria which makes sourdough so special.

As the microbes grow and live and ferment, the *Lactobacillus* produce lactic acid and the yeast produce alcohol, giving the bread a tangy and acidic flavour. The acid in the dough also keeps out other types of fungus and bacteria, so the eventual bread has a longer shelf life. The microbes also digest gluten, meaning that real sourdough should either be low in gluten or gluten-free—so it might be an option for people with gluten-intolerance and celiac disease (but best check with your doctor or dietician first).

> FUN FACT:
> *The lower amount of sugars means sourdough also has a lower glycaemic index than many types of other bread.*

YOU MIGHT BE EATING 100-YEAR-OLD SOURDOUGH

In the past, bakers found they could save some leavened sourdough to add to new mixtures, which would convert them into more sourdough. With careful feeding of flour and water, these so-called 'starter doughs' can be kept alive indefinitely. In fact, there are starter doughs in modern bakeries that may be hundreds of years old.

Across the world, jars of starter doughs have been treated like family heirlooms, passed down through generations. Starter doughs were carried by frontier settlers and Gold Rush prospectors, snuggled at night to keep them warm and alive.

> FUN FACT:
> *Each starter dough really is unique, a potted history of local flour and microbes from the environment –including the Lactobacillus found naturally on the baker's hands.*

Traditional sourdough continues to be made and sold today in bakeries and artisanal markets. There's a sourdough library in Belgium which aims to collect and catalogue starter doughs from around the world. In Sweden, a sourdough hotel will maintain your starter for you while you're on holiday. You could even make your own starter using just flour, salt and water, or purchase a regional starter dough online.

BUT IS IT REAL SOURDOUGH?

But while some bakers are fiercely proud of their traditional sourdough and treasured starter doughs, there is no legal definition of sourdough. It's really the *Lactobacillus* which is key to creating sourdough, yet there is no official legislation stating a sourdough loaf has to contain any *Lactobacillus*.

Though 30-50% of European breads are produced using sourdough, industrially-produced sourdough uses dried starters rather than a spoon of sticky dough from a treasured pot. Other 'sourdough mimics' are likely leavened using yeast, and artificially soured with additives. And sourdough mimics may not have the time or microbes needed to break down the gluten in grains. Which means, if you are gluten-intolerant or avoiding high GI-foods, there is even more reason to care whether your sourdough is authentic or not.

For the full article with references, see foodunfolded.co/sourdough.

Homemade Ginger Beer Fermented Soda Recipe

by Astrid Vandromme
based on recipe by Anne-Marie Bonneau (@ZeroWasteChef)

When my sister and I started to get interested in the zero-waste lifestyle, there were a few things that we thought we would have to give up in order to reduce our plastic use—sodas being one of them. We started exploring ways to make it ourselves and our love of ginger beer was born!

It was challenging at the beginning and we took our time perfecting our recipe, learning tricks along the way. I discovered quickly that the best thing about this ginger beer is that you can make it a true soda or a probiotic drink! Since it's homemade, you can adjust the sweetness, the strength of the ginger, add another flavour (green tea or lemon are both amazing) and personalize it, making it new and different each time.

Astrid

Note: This recipe is broken down into two steps, as you will need a 'ginger bug' for your ginger beer. Ginger bug is to ginger beer what a starter is to sour dough!

FOR THE GINGER BUG

Grated unpeeled organic ginger	75 ml
Granulated sugar (any sugar)	75 ml
Water	375 ml
Glass jar, sterilized	~500 ml
Breathable cloth (cotton) & an elastic	

TO MAKE YOUR GINGER BUG:

In your jar, combine the water, ginger and sugar and stir vigorously. Cover with the cloth and secure with the elastic. Leave it at room temperature for one day.

After one day, feed it every day for the next five days. That means adding 15 ml of grated ginger and 15 ml of sugar (about 1 tablespoon of each) and stirring it vigorously. Cover it and leave it at room temperature.

After 5 days, the mixture should be bubbly, cloudy yellow and sludgy with a yeast-like smell. If the ginger floats, this means your ginger bug is ready to use!

Refrigerate for 1-2 weeks (before making your ginger beer). This gives time for the ginger bug to mature a bit. Make sure it feed it every week.

Don't forget to give it a name! It may sound ridiculous, but it will help you to remember to feed it (mine is Gingerella!).

FOR THE GINGER BEER

Organic ginger	10cm
Water	750 ml + 1750 ml
Sugar	250 ml
Your ginger bug liquid	+/- 150 ml
Glass bottles, sterilized	

TO MAKE YOUR GINGER BEER:

If your tap water is rich in chlorine, leave the water to evaporate the day before for at least 8 hours before making your ginger beer. Take your ginger bug out of the fridge and keep it at room temperature.

Combine 750 ml of water with the 10 cm of sliced ginger and bring it to a boil. Let it simmer for about 20 min. This is where you can add other flavours if you wish. To add the sugar, turn off the heat then let it cool completely. This is very important because heat kills bacteria.

Combine this mixture with 1750 ml of water.

Stir your ginger bug vigorously. The bacteria will be at the bottom, and this is what we want to stir very well before extracting the mixture. To do so, strain the ginger pieces out of the liquid—you don't want the ginger, just the liquid.

Add the ginger bug liquid to this mixture then redistribute the new liquid into separate bottles. Close the bottles very tight and leave them at room temperature.

Feed your ginger bug again, and put it back into the fridge, covered with its cloth.

After 2 days (or just one day if it's very warm), burp your bottles. This means opening and closing them very quickly. If it bubbles, that means it worked!

Burp the bottles every day after that for 3 days.

5 days after the original brewing, put them in the fridge. They are ready to enjoy!

Special Diet Information
Since this is fermented, it might contain a bit of alcohol.

KELLY OAKES

How Fruit Always Arrives Perfectly Ripe

There's nothing like biting into a perfectly ripe peach or a juicy apple. But how do these fruits make it all the way from where they're grown, to us–and arrive at just the right time?

THE SCIENCE BEHIND FRUIT RIPENING

When fruits ripen, they become softer, sweeter, and more brightly coloured. Their colour change happens as chlorophyll (the pigment that makes plants green) breaks down, while other colourful pigments like anthocyanin and carotenoids accumulate. The fruits' sweetness comes from starches inside the fruit breaking down into simpler sugars, like glucose and fructose. And their softness comes from cell walls breaking down.

Fruits fall into two categories in terms of ripening: either they will keep ripening by themselves once they are picked, or they won't.

Those that continue ripening are known as 'climacteric' and include apples, bananas, pears, apricots, peaches, blueberries and plums. Those that stop ripening once they're picked are called 'non-climacteric', and include citrus fruits like lemons and limes, raspberries, strawberries, grapes, watermelon, and pineapple.

IT'S ALL ABOUT ETHYLENE

Climacteric fruits produce a burst of ethylene gas, which acts as a plant hormone, when they start ripening. Non-climacteric fruits also produce ethylene, but they don't release a spike of it like climacteric fruits do. They can, however, ripen further before they're picked, if they are around ethylene produced by other fruits or an external source.

Since an ethylene spike signals the start of ripening for climacteric fruits, dampening down the levels of ethylene around them can slow down the ripening process–allowing producers to store climacteric fruits (like apples) for a long time before they reach supermarket shelves.

But how do producers keep ethylene levels down?

DELAY RIPENING WITH LOWER TEMPERATURES

The first step for producers to keep fruit from ripening before it reaches you is to pick it at the right time. Once the concentration of ethylene reaches a tipping point of 0.1-1.0 ppm (parts per million) around the fruit, it's too late to stop it ripening.

Apples, for example, can be stored for several months after harvest, as long as they're picked before they start to give off too much ethylene. But once they reach peak ripeness on the tree, they'll only last about a month after they're picked, depending on the storage conditions.

One way to delay ripening is to use cold storage. Low temperatures slow down the reactions inside the fruit that make it ripen. In fact, low temperatures have been used to keep apples crisp since the 1800s, when apples were exported from the U.S. to Europe in wooden barrels in the chilly holds of old shipping vessels.

HIGH-TECH RIPENING

Another method to delay ripening is more high tech. Controlled-atmosphere storage (CAS) systems not only regulate the temperature of the room but can precisely calibrate the levels of different gasses where fruits (like apples) are stored.

Fruit needs oxygen to make ethylene and ripen, so by keeping oxygen levels at 2%–instead of the 21% found in normal air–and increasing carbon dioxide levels, CAS can slow the ripening process right down and essentially put fruit into a kind of hibernation.

A third way is to use materials that absorb ethylene from the air, like chemical compound potassium permanganate or a synthetic compound called 1-methyl-cyclo-propene (also used to keep cut flowers fresh), to limit the fruit's exposure to ethylene.

Once a producer is ready to ship the apples to supermarkets and greengrocers, both ethylene and acetylene–similar chemical compounds–can be used to ripen apples in ripening rooms with controlled temperature and humidity to make sure they're crisp and juicy when they reach consumers.

HOW TO RIPEN FRUIT AT HOME

While a lot of technology keeps the fruits in good condition before they reach you, you can take advantage of the same chemistry to help them cross the threshold from almost-ripe to perfectly ripe in your fruit bowl at home.

Bananas produce a lot of ethylene, so you can give other fruit, like not-quite-ripe peaches, a helping hand by storing them together. The ethylene from the banana should help ripen the peaches quicker than if it were left to its own devices.

For the full article, see foodunfolded.co/perfectlyripefruits

ANNABEL SLATER

Food on Ships
Secrets to Preserving Food

Food preservation is a battle against bacteria, a fight against fungi. On ship journeys, how have humans tried to win the microbial war?

"Englishmen, and more especially seamen, love their bellies above anything else," wrote Samuel Pepys, famous 17th century British diarist and administrator of the Navy. Pepys was writing during the Age of Sail (around 1571–1862). Wherever we travel, we need to eat and drink, and this was a crucial problem for seafaring journeys. With long voyages of many weeks and months, how did they stop food from rotting?

FOOD PRESERVATION USING SALT

Rotting occurs as fruit and vegetables ripen and begin to decay. On food, bacteria and fungi digest food, often producing toxins that make us sick, and odours which we have evolved to find distasteful. The microbial enemy is too numerous to wipe out—the more effective approach is to make it difficult or impossible for harmful microbes to grow.

Like other living things, bacteria need food, oxygen, water, warm temperatures, and a comfortable pH environment. Over a thousand years ago, the Vikings dried out fish and meat for their longboat journeys. But this was not the preferred method in the Age of Sail. Drying meat is a lengthy process, and it was hard to keep moisture out on long journeys. Instead meat was preserved in barrels of salt and brine. Being in a salty environment draws water out of living cells (through osmosis), dehydrating the bacteria and keeping meat edible for months—though, taste being something of a secondary concern. Still, salted meat was far easier to keep on a ship than livestock animals.

SCURVY-FREE WITH SAUERKRAUT?

Fruit and vegetables could also be pickled in sealed containers of acidic liquids like vinegar, or sour whey (as the Vikings also used). Most bacteria can't tolerate acidic environments. But some fermenting bacteria like non-harmful and beneficial *Lactobacillus* can produce useful products and flavours. Though pickling and fermenting are two different processes, some pickled products are also fermented. As fermentation produces acid, fermented foods from cheese to salami to sauerkraut also have a longer shelf-life.

But, in the past the limited food on ships led to health problems. Scurvy, a degenerative disease caused by lack of vitamin C, was the 'plague of the oceans' and it was expected to cause 50% of crew deaths—with at least two million people dying between 1500 and 1800. Taking sauerkraut on ship journeys would have helped to prevent scurvy, since pickling preserves much of the vitamins in vegetables.

But pickled vegetables didn't have to be the only option—Chinese mariners had long avoided scurvy by taking soybeans on board, which provide vitamin C when they sprout.

PRESERVING FOOD ON CRUISE SHIPS

Nowadays the industrial age has brought canning, freezing and refrigerating to preserve even food on ships. Although canned and preserved foods have entered into a cruise's menu, an abundance of fresh fruit and vegetables can be preserved through careful storage, refrigeration, and science. Fruit and vegetables produce ethylene gas as they ripen, which in turn, speeds up the process. So, ripening can be slowed by putting special ethylene-absorbing mats in refrigerators, allowing salads to be available for over a month.

But some age-old problems remain: microbes have to be slowed or controlled. While an abundance of fresh fruit and vegetables can be taken onboard, they need to be scrupulously checked for any mould or damage. There are also modern problems with food that is packaged, pasteurised and preserved.

I spoke to Bert Bakering, head chef of the marine research ship RV Falkor to learn more about food and drink preservation aboard ships. "At some ports you have fresh milk that only stays fresh for seven days, but in the United States there is also milk that stays fresh for about 30 days," Bert mused. "So, I need to find the right brands. And if you go to Fiji or those sorts of faraway places, a lot of stock is out of date when you buy it, or there are weevils inside the flour. So, we try to plan ahead. Because if you get 50 kilos of flour to make bread but have to throw it away, then I don't have bread in the freezer..."

With onboard desalinisation plants, ships also have no shortage of fresh water–Falkor's plants can produce around 1000L of freshwater an hour.

It seems nowadays, feeding a crew is no longer just a matter of survival and nutrition. The challenge is delivering taste and enjoyment in every meal for a crew typically requiring three meals a day, several hundred meals a week, and so a few thousand meals over several weeks.

For the full article, see foodunfolded.co/foodonships.

Ón Fharraige

Gaeilge (Irish) meaning '**from the sea**'.
Mysterious and beautiful, the ocean greatly gives but we shouldn't always just take. Discover what fisheries are doing to include more sustainable practices.

PHOTOGRAPH: KIRSTYN BYRNE

Where is your fish from? Tracing your fish back to its origins

Traceability is a recurring term when it comes to fish safety and fishery sustainability. But what does that even mean?

Traceability is the overarching term, which describes the ability to trace the history of a (food) product through its production and full life cycle. This system of traceability is basically a record of where the product has been, who was in contact with it and the stages of processing. It records the whole supply chain.

WHAT INFORMATION IS TRACKED

Currently there are multiple guidelines and principles for traceability when it comes to fish. The Food and Agriculture Organization (FAO) of the United Nations has a list of points based on extensive case studies, by which fisheries should comply to. The World Wildlife Fund (WWF), together with industry partners, offers propositions for the traceability of wild-caught fish.

The WWF set up six principles that should be the foundation for a framework of traceability. They are a little theoretical, but it can be a guideline for many companies and fisheries. These six principles are:

1. The Essential Information. All information regarding a caught fish (measurements and all 'W- questions' like who? what? when? how? etc.) to ensure it's a legal catch.
2. Full-Chain Traceability. To track the whole chain from sea to table in detail.
3. Effective Tracking of Product Transformation. Where and how the product was transformed (if transformed) to verify the legality and sustainability.
4. Digital Information and Standardized Data Formats. Electronic data, proper labelling and tracking through standardised data formats.
5. Verification. Information must be provided so government or external parties can verify and assess the fish.
6. Transparency and Public Access to Information. The system needs to be transparent so everyone (from grandmother to Queen Elizabeth) can make conscious decisions based on the supply chain information.

IS FISH TRACEABILITY REALLY THAT SIMPLE?

In theory tracking a fish sounds easy, but in practice it gets a little more complicated. It involves a lot of stickers and keeping track of these stickers with the right fish and verification.

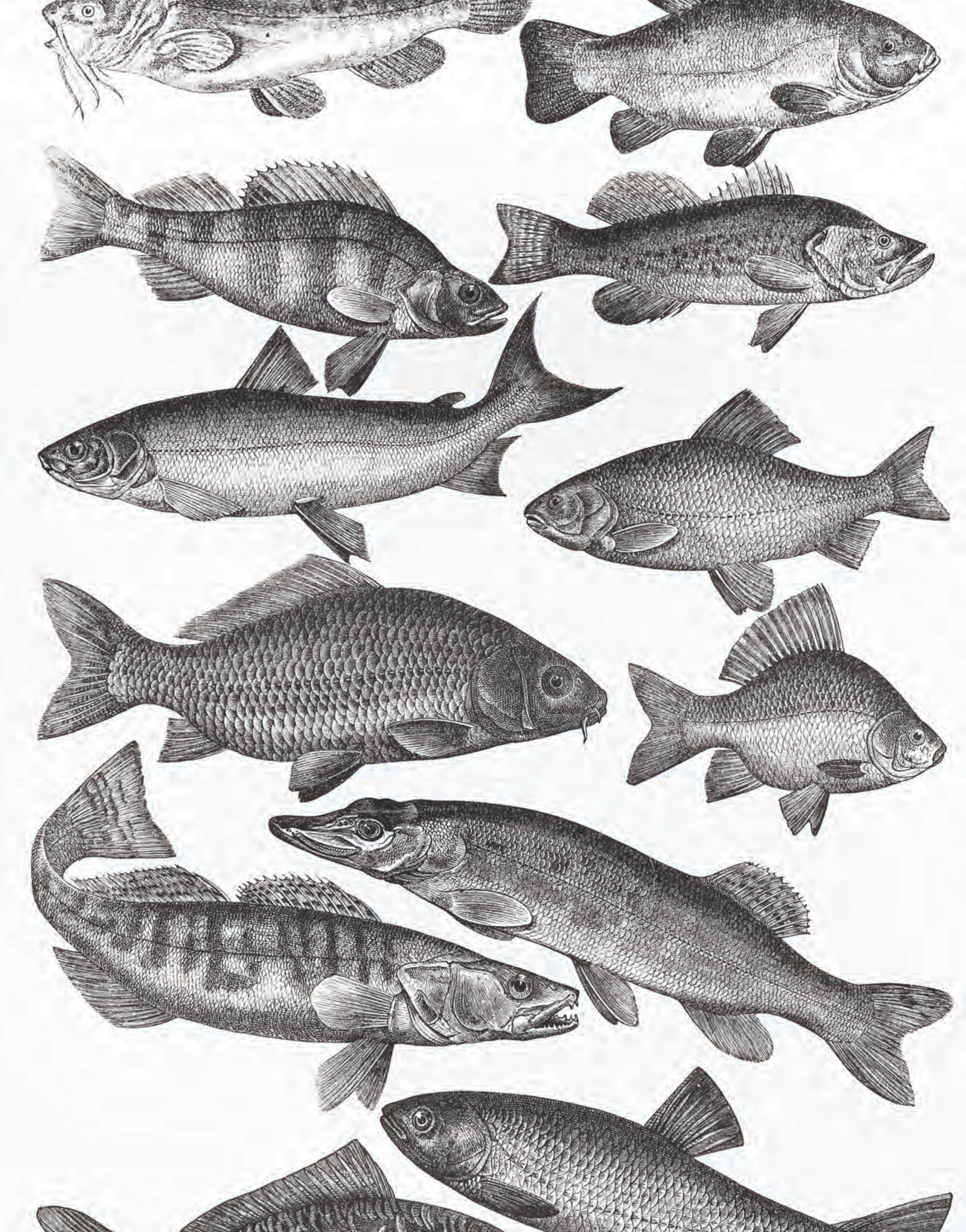
When the fish is pulled out of the ocean, it is labelled with a sticker that describes its species and weight, who pulled it out, date, grade and price. This coded sticker will stay with the fish during the transformation process. Once the fish (whole or in pieces) is ready to be vacuum packed, it gets a new sticker. Some fish auctions even have tracking barcodes for the boxes that hold fish.

These stickers have number or barcodes that can be read to gain traceability information about the fish. This information is also logged into an electronical system, so it can be accessed easily. To be clear, these stickers are not called stickers but IDs. Fresh fish are given a Raw Material Identification (RM-ID), and when the fish is transformed into a product and shipped to restaurants or markets, it will be labelled with a Finished Good Identification (FG-ID).

During the whole process the fishermen keep a logbook with all the above-mentioned information. This can also be accessed by external parties such as responsible government organisations. This allows them to control if the fish were caught legally but also adds to 3rd-party verification.

One issue with this traceability system is that it only tracks the fish that are brought back to consumers. So, fish that are caught on the boat (but not used) will be thrown out into the sea without any tracking. Therefore, it is incredibly difficult to measure just how much fish is actually caught each year.

For the full article, see foodunfolded.co/tracingfish.



JESSICA TENGVALL

Spotting Sustainable Seafood: The MSC Label

Have you ever noticed the little blue logo on some fish products and wondered what the three letters 'MSC' mean?

Well, MSC stands for *Marine Stewardship Council*. They assess if a fishery is well managed and sustainable, and grant certifications based on set standards. Not only does the blue label make it a little easier for us to distinguish between sustainable and unsustainable seafood, but the certification is also to help recognise fisheries for being sustainable.

WHAT ARE THE MSC SUSTAINABLE STANDARDS?

First, a fishery applies to be assessed by the MSC Fisheries Standard. A council of scientists, conservation groups, and fishery industries then review the fishery accordingly based on these standard requisites:

Three core principles

1. Sustainable fish stock focuses on maintaining a productive and healthy fish population. Meaning, that enough of the target fish remains in the ocean to ensure that the fishery is not fished to extinction. This means, for example, that if the fish population drops below the sustainable level that has been suggested to uphold, the fishery should reduce its main catch. So, the main catch needs to be monitored regularly.

2. Minimisation of environmental impact, so that the habitat and surrounding species can endure through time. If the fishery unintentionally catches other fish species, this needs to be noted, otherwise fishing can threaten other populations. So, a strategy must be in place to reduce unwanted death of those species. On top of that, the fishery must have a strategy to minimise their habitat impact.

3. Effective fisheries management, including objectives and responsive enforcement systems that sustain livelihood for the people who depend on present and future fishing.

Overall a fishery cannot apply if: 1) they are targeting amphibians, reptiles, birds or mammals, 2) use destructive fishing practices such as explosives or poison, 3) if they have been prosecuted for forced and child labour violations within the last two years, or 4) if a fishery has been conducted under a controversial (unilateral) exemption to some international agreement.

SO, IS IT EASY TO BUY SUSTAINABLY CAUGHT FISH?

Unfortunately, no. Although a seemingly good certification system, MSC has been criticised for being too lenient and discretionary in their certification of fisheries. Things get more complicated when big food retailers pledge to purchase all its fish products from MSC-certified fisheries. For example, Walmart and MSC made an agreement in 2006, because Walmart pledged that they would buy all their seafood from MSC-labeled fisheries by 2011, which put pressure on MSC to certify large fisheries more quickly in a specific amount of time.

And, to gain the blue MSC logo certification, the fishery applying must pay for it. This money is used for the certification process and for MSC to run its business of staffing and so on. But, the problem is that it might exclude perfectly sustainable fisheries (often smaller fisheries), because they cannot afford the certification. It can cause confusion among us consumers since the lack of certification does not always mean that a fishery is not sustainable.

What's more is that once a fishery has an MSC certification, there is little incentive to improve the fishery towards higher levels of sustainability. And the more fisheries that become certified, the less distinction there will be between those that are more sustainable than others.

THE BOTTOM LINE

The MSC states that their certification reflects the 'most up-to-date' standard of sustainable fisheries. And, the MSC actually invites external experts to comment on the fishery certification process.

While it is not a perfect system, it does help ease the process of buying fish products that are a little more sustainable. Just bear in mind, we should be aware there are products that can be highly sustainable, but just cannot afford the certification.

I don't know about you, but I personally find it difficult to find the time to look up every species of fish that I want to buy, where and how it was caught. So, if you are looking to save time but not wanting to compromise too much on sustainability, then it seems to be worthwhile keeping an eye out for the blue fish logo. But, if you are someone who feels that you have the time to go into the depths on what is the most sustainable fish to buy, I suggest reading more at foodunfolded.com.

For the full article with references, see foodunfolded.co/MSClabel.

The Ins & Outs of Seaweed Farming

Seaweed, the weed of the sea! Why not make the most of this nutritious sea vegetable? Here's how modern seaweed farms are growing and harvesting this sea plant.

You probably don't realise it, but you use products containing seaweed every day. You can find it in toothpaste, cosmetics, beer, ice cream and paints. On an industrial level, it is used as a green fuel, in fertiliser and animal feed—all with little environmental repercussions.

Seaweed is quickly becoming a unique staple ingredient in our food. Known for its umami flavour and as an alternative to salt, Michelin-star chefs have embraced the range of edible seaweeds as an exotic addition to ocean-inspired plates. Seaweed is high in protein, omega oils and a range of vitamins and minerals, so it's easy to see why it is growing in popularity among our health-conscious society.

But how are seaweed farmers meeting these growing demands for seaweed?

TRADITIONAL SEAWEED HARVESTING

Seaweed has long been a significant part of East Asian diets. And for centuries, wild seaweed harvesting has been part of coastal community culture across Northern Europe and the British Isles. How did they grow and harvest seaweed?

Picture a rugged coastline. Local townsfolk wade into the murky seawater among the rocks to hand pick rubbery leaves of dark green and brown. Or in the calm after a storm, they wander along a shoreline gathering washed up seaweed fronds. Back then, people knew the seasons for picking, and how to use each type of seaweed. In many communities, women would take the lead in gathering seaweed for food to sell locally.

Today, harvesting wild seaweed contributes to the majority of seaweed production in Europe, with the largest producers being in France, Norway, Ireland, Iceland and Russia. In Ireland, 10,000 wet tonnes of seaweed are gathered each year from a single beach in Cork.

FUN FACT:
Consider, for example, the rich history of "Irish Moss". In 19th century Ireland, seaweed was gathered and dried for use in flans, tonic and beer, and was even thought to have medicinal properties.

MODERN SEAWEED FARMS

But traditional methods of gathering wild seaweed is by its nature unreliable. The work is labour intensive and costly. Experts observed that the "increasing demand for seaweeds as food products can only be adequately met by cultivation." According to FAO, 96% of global seaweed production is now in cultivated farms rather than wild harvesting (including other uses like fuel, as well as food).

The type of cultivation depends on how the species of seaweed replicates and reproduces. The simplest and most common cultivation method is to attach pieces of seaweed to rope lines or nets that are suspended in the sea often near the coast. They hang on wooden stakes or on a floating wooden framework dug down into the seabed.

Nori, the black seaweed used in sushi, is grown using nets that spores settle onto. The nets are hung at a depth that allows the seaweed to be exposed to the air for a few hours a day when the tide is out. Another technique, used to grow Sea Grapes or "Green Caviar", is simply planting a cutting of seaweed (about 100g) into the seabed to help it take root.

HOW SEAWEED IS HARVESTED

While the majority of seaweed harvesting in the UK is still gathered by hand at low tide, other countries harvest wild seaweed with boats and machinery, using a rake or trawler methods. This is much more efficient than hand collection, but, if used excessively, can have a severe habitat impact as it can pull up other seaweeds and disrupt sea animal homes.

But, seaweed harvesters have given an encouraging amount of thought and attention to this issue. For example, in Norway, the rake method only removes the top floating canopy of seaweed, which allows the seaweed to regrow over the next two years and minimises disruption of the seabed.

THE SUSTAINABILITY OF SEAWEED

In addition to providing food and shelter to all the creatures inhabiting its aqua ecosystem, seaweed forests can decrease carbon dioxide on the surface of the sea and in the atmosphere. Seaweed also absorb dissolved nutrients from the water, which can decrease eutrophication caused by water pollution.

One cautionary warning is that as a natural filter, seaweed can have high levels of iodine and metals if exposed to polluted water. This means that although nutritious in many ways, seaweed can be harmful if consumed too much.

Now that you know a bit more about seaweed and how it's grown, would you eat more of this sea vegetable?

For the full article, see foodunfolded.co/seaweed.

Adding dried seaweed to cow feed can reduce their production of the greenhouse gas methane by 99%.

Word Search

G	T	W	W	F	J	V	D	A	G	I	N	U	O	W
T	N	F	E	R	M	E	N	T	A	T	I	O	N	E
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AGRITECH
AQUACULTURE
BIODEGRADABLE
COMPOST
COOKING
CRISPR
FERMENTATION
FOODUNFOLDED
ORGANIC
PESTICIDES
SEAWEED
TRACEABILITY
VEGETABLE
VERTICALFARMING
WATERFOOTPRINT

ANSWERS PAGE 98

KATHARINA KROPSHOFER

Spirulina How It's Grown

The algae spirulina was already harvested by indigenous people in Mexico and Chad. Today, scientists have developed a modern way of growing them–including a huge system of glass tubes.

ANCIENT, GREEN GOLD

For scientists it is an exciting field of research; entrepreneurs look at it as a resource of the future; and for some, it is a contribution to a healthy diet. The allrounder's name? Spirulina. What might sound like a type of pasta or the newest addition to Marvel's world of superheroes, is the name of a specific algae.

We can find 30,000 different species of algae in our oceans, fresh water, in the air, snow or soil. They come in different sizes and groups, from microscopic small ones to kelp, which can grow up to 45 meters long.

Some of them, like green algae, belong to the kingdom of plants. Others, like spirulina, belong, in fact, to a group of micro-organisms called cyanobacteria, also known as blue-green algae (and yes, their names derive from their colouring). They use a pigment called phycocyanin which gives them their specific colour and which they use for photosynthesis. Cyanobacteria have been doing this for quite a while: as one of the oldest organisms on Earth they form a biofilm which, when fossilized, has been proven to be up to 2.7 *billion* years old.

WE CAN EAT ALGAE?

Humans use algae in different ways. Generally, they are low in carbohydrates and high in protein, presenting an alternative to animal products. Billions of tonnes grow every year in our oceans, not wasting precious arable land. Experts even think that every second molecule of oxygen in the atmosphere is produced by algae. They breathe more CO_2 than common agricultural crops like wheat or corn, meaning they are great for carbon storage and as a source of nutrition–so why not eat them too?

500 kinds of algae are eaten, often as dietary supplements. Most of us are aware of seaweed, green, red or brown algae, which are part of diets in China, Japan or Korea but also in traditional European societies in Iceland, Norway or Wales. They are high in fibre and consist of up to 60% protein with vitamins and mineral compounds working as antioxidants in our bodies. And then there are the essential Omega-3-fatty acids, something normally associated with fish.

THE CURIOUS CASE OF SPIRULINA

Spirulina has always been a special case: indigenous people harvested algae from flat, sub-tropical to tropical waters with a high salt content. When Spanish invaders reached the shores of Mexico, they discovered that Aztecs, close to the capital Tenochtitlan, were collecting "new food" from lagoons. This was turned into blue-coloured cakes and it is even said that marathon runners took it for extra energy. Spirulina, or as they call it "dihé", is also one of the major protein sources in Chad. People living close to Lake Chad show low levels of malnutrition despite living mainly on millet.

Modern industry has found a new way to grow spirulina. Aquacultures, so-called open ponds, are common. Successful growth depends on the right amount of light, temperature (up to 37 °C), stirring speed, pH, water quality, the presence of nutrients like carbon or nitrogen, and so on. To harvest it, the algae culture is pumped through a filter or a centrifuge and then dried in the sunlight or with hot air.

GROWING SPIRULINA IN GLASS TUBES

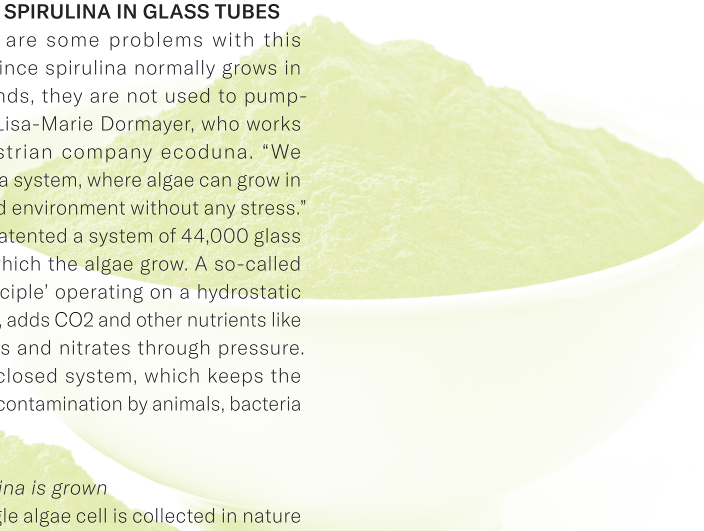
Yet, there are some problems with this system: "Since spirulina normally grows in steady ponds, they are not used to pumping", says Lisa-Marie Dormayer, who works at the Austrian company ecoduna. "We developed a system, where algae can grow in a controlled environment without any stress." Ecoduna patented a system of 44,000 glass tubes, in which the algae grow. A so-called 'air-lift principle' operating on a hydrostatic equilibrium, adds CO2 and other nutrients like phosphates and nitrates through pressure. It is an enclosed system, which keeps the algae from contamination by animals, bacteria or dirt.

How spirulina is grown

First, a single algae cell is collected in nature and then grown in the lab on a nutrition medium until it can be inserted into the big tube system. In an ideal case, cells divide once a day, while being transported slowly through the pipes (one "lap" takes 12 hours). After four to ten days they are ready for harvest. "We take a part of the cells from the system. Too many would hinder perfect conditions for growth", explains Dormayer. To replace the removed cells, nutrients and water (80% of it recycled) are added.

Glass tubes require less cleaning than ponds which means algae can be produced almost non-stop. The clear glass allows the system to be powered by sunlight with tubes positioned vertical towards the sun. With no additional lighting necessary, ecoduna's production is very sustainable. They also refrain from heating (except to keep employees from freezing). Instead, a local type of algae is used in the winter. This species, which is yet to be licensed, requires lower temperatures than Mexico-descendent spirulina. During days of low sunshine, productivity is simply lower as well. At the end of the process, algae are dried and processed into the green powder we all know–and maybe also love.

For the full article & references, see foodunfolded.co/spirulina.



For a free online course on the myths and truths behind superfoods, see back for details.

Whiting Ceviche & Yellow Courgette with Sea Buckthorn Berry Gravy

by Bruno Timperman, NorthSeaChef

We are the NorthSeaChefs, a not-for-profit organization that stands against overfishing by promoting lesser-known, unloved fish species, especially by-catch fish. We support local Belgian fisherman in their efforts to fish sustainably.

With creative recipes and technical guides, we encourage other chefs, amateur chefs and consumers to responsibly and respectfully cook fish. We want to give these fish their own identity, because these lesser-known fish have so much more to offer than most people think, and also out of respect for our fishermen and their catch.

"We have to learn to eat what the fishermen catch, not just have them fish what we want to eat and throw everything else away."

The NorthSeaChefs

WHITING

Whiting fish	350 g
Salt	

TO MAKE THE WHITING:

Filet your whiting or ask your fishmonger to prepare your whiting filet.

Cut the fillets into wafer-thin slices.

Season to taste with salt and refrigerate

YELLOW COURGETTE

2 yellow courgettes	
Sugar	100 g
Lemon vinegar	200 ml
Water	300 ml
Cling film	

TO MAKE THE YELLOW COURGETTE:

Mix the sugar with the lemon vinegar and water to make a sweet and sour marinade.

Cut wafer-thin slices of the courgette and place them in the sweet lemon marinade for 15 minutes.

Arrange the marinated courgette slices on top of the cling film.

Place the slices of whiting on top of the courgette, roll the cling film tightly so that you get a nice and firm roll.

Cut the roll into 4 slices, remove the cling film and fold the slices with tweezers into a flower.

SEA BUCKTHORN BERRY GRAVY

Sea buckthorn berries	500 g
Orange juice	100 ml
Olive oil	50 ml
Xantana (thickener)	
Salt	

TO MAKE THE SEA BUCKTHORN BERRY GRAVY:

Keep a few sea buckthorn berries separate for finishing.

Mix the rest of the sea buckthorn berries with the orange juice and olive oil.

Add a pinch of Xantana and mix into a smooth emulsion.

Season to taste with salt.

FINISHING

Handful of sea buckthorn berries
Yellow mustard spice flowers
Dill

TO MAKING THE FINISHING:

Spoon the sea buckthorn berry gravy in the middle of the plate.

Arrange the ceviche of yellow courgette and whiting on top.

Finish off with yellow mustard herb flowers, sea buckthorn berries and a few dill pickings.

Other by-catch fish to consider cooking
Dogfish, red gurnard, weever, pikeman, pout, megrim, haddock, cuttlefish.

OLIVER FREDRIKSSON

Fish Farming
3 Commonly Farmed Fish

Just how much of the seafood that we see on our shelves is farmed or cultured? And how exactly is it produced? Here are ***3 commonly farmed fish*** *you are likely to have seen in your shops and the stories of how they got there.*

1. SALMON

As one of the most well-known fish on the market, salmon is one of the staple fish on menus around the globe. Recent technological advancements, selective breeding and high market value have made the familiar pink-fleshed fish available to meet customers' demands. Farmed salmon comprises over 70% of the salmon market, so chances are if you have eaten salmon, then you have eaten farmed fish.

FARMED SALMON

Farmed salmon are the product of carefully selected brood stock (larger breeding fish). In order to breed the most ideal traits into fish cohorts, breeding fish are chosen based on the most desirable genetic characteristics to be passed onto future stockings—characteristics include fish size, fat content, physical appearance and fish health. Eggs and milt are collected, with hatchlings held in land-based rearing tanks.

Recirculating aquaculture systems (RACs) in these tanks minimises wasteful water use, and allow factors like temperature, oxygen and salinity to be carefully controlled. The juvenile salmon will generally spend between 8-16 months in these holding tanks until they are large enough for transport to sea cages or 'net pens'.

In the net pens, the fish remain for another <18 months until they grow large enough (~5kg) to be gathered with float-lines or seine nets. The farmed salmon are then fished out to be prepared for commercial handling.

2. TUNA

Despite what many think, farmed tuna only account for less than 1% of the total tuna market. All the tuna that you would typically eat for sushi or even canned is wild caught. The only tuna species that are farmed are Bluefin tuna and Yellowfin tuna. But, farmed tuna will rarely be seen in the tins on shelves at your supermarket. Instead, they are sold at fresh markets or exported frozen to high-end restaurants.

FARMED TUNA

In farming operations, unlike salmon or land-based species, we still cannot rely on tank-rearing populations of tuna. Limited success with spawning and juvenile success rates in controlled environments has left tuna producers opting for open water 'ranching' as their farming option.

With the open water 'ranching' method, seine nets capture schools of juvenile tuna. The fish are then transferred through underwater gates into floating sea-cages to be grow over a course of months or even years before they are sold commercially.

3. PANGASIUS ('BASA')

Sold in over 130 countries, the humble 'basa' or 'pangas' as it is commonly labelled, is one species many of us have come across (even if you might not know its name). Basa fish are sold primarily as frozen fillets, so this Indo-China based catfish has seen itself as the fish of choice for many on a budget.

FARMED PANGASIUS BASA

Wild-caught pangasius lack any regulation, so almost all basa sold globally is now derived from farmed sources.

Pangasius fish doesn't require much oxygen to breathe, is pollutant tolerant and quick breeding by nature, all making it an ideal species for productive aquaculture. Pangasius basa fish also have a low food conversion ratio (FCR). Put simply, it takes less to grow more when it comes to pangasius.

Pangasius brood stock are often given hormonal treatments to induce spawning, while its eggs and milt (sperm) are fertilized in separate facilities. Newly hatched larvae are then transferred from hatchery to a nursery, usually into 'earthen ponds', running adjacent to rivers or waterways where water exchange can be easily controlled by flushing ponds with river water. In some cases, small fish are then transferred into grow out net-pens that are located on the tributaries or rivers themselves. Here the pangasius spend another 6-8 months until they reach harvest size of ~1kg.

Important note: Brood stock are maintained in controlled and enclosed systems, and so hormonal treatments do not leak into the outside environment.

For the full article, see foodunfolded.co/farmedfish.

SAMANTA OON

Aquaponics: Sustainable Urban Farming

New types of farming are cropping up every day, and aquaponics is one of them—even though the technique has actually been around for centuries. It's a sustainable way to grow fish and vegetables in the same system without needing chemicals, pesticides or even energy from fossil fuels.

The face of farming is changing. With over half of the global population now living in concrete jungles (aka: cities), urban farming can help mediate issues related to food production. As urban farming grows in popularity and practicality, techniques like aquaponics become more important to help sustainably ensure food security.

But what is aquaponics? In short, aquaponics is a hybridisation of the fish farming of aquaculture with the soilless growing of plants through hydroponics.

AN ANCIENT TECHNIQUE

Modern aquaponics can be done almost anywhere given the right set up, but the idea for a mutually beneficial system of fish and plants isn't new at all. In fact, the Aztecs built *chinampas* which were a sort of island platforms for plants to grow in shallow lakes.

Throughout Asia, it's common to find fish swimming in and amongst growing paddy rice fields. Chinese written records show this practice dates back as far as 2,000 years ago and has been shown to naturally reduce numbers of pests and weeds in rice fields. Researchers drew on these historical techniques and added improved technology to develop a more efficient and productive form of aquaponics.

WHAT'S INSIDE AN AQUAPONICS SYSTEM?

A typical modern aquaponics structure includes a network of pipes connecting a fish tank, a water pump, and a plant bed where vegetables can be planted in gravel as water is pumped through it.

AQUAPONICS SUSTAINABLE BENEFITS

A major advantage of aquaponics is that you can grow a full meal without using any chemical fertilisers or pesticides. These systems can even go fossil-fuel free by utilising solar panels to power their pumps, and aquaponics uses minimal water because water is continually recycled through the pipe system with only a small amount evaporating.

There is a lot of flexibility in the design of aquaponics system, so they can be adapted for places like rooftops, basements or brownfield land. Farmers in underdeveloped rural communities can even use aquaponics to grow crops all year round in a limited space, despite water often being a precious commodity in remote areas.

MAKE YOUR OWN AQUAPONICS TANK

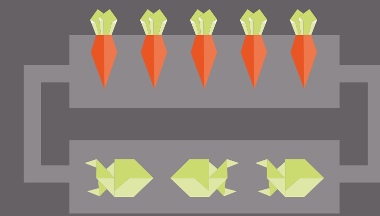
You can also try making use of your own fish tank at home–there are many guides and starter kits available online for people interested in aquaponics. To hear which features are included in the system and why, we have a podcast available online (try the Spotify QR code to the left).

FUTURE OF AQUAPONICS

In the future, newer technology can be incorporated into aquaponics systems to enhance their function. Think sensors that autonomously monitor various key components of the system like water temperature, pH or volume, or an alert system that tells you if the water pumps aren't working. As the technology for aquaponics improves, so will its efficiency and who knows? Maybe we'll all be growing our own fish and veggies someday.

For the full article with references, see foodunfolded.co/aquaponics.

Use Your Fish Tank to Grow Herbs & Vegetables



Aquaponics grows herbs and vegetables without soil through a close-looped system with the following 3 key components:

1. Fish

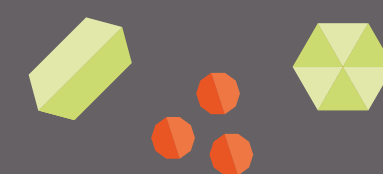
Tilapia is the favoured fish for aquaponics farmers because they're a hardy species that grows well in recirculating water. The fish's waste supplies the nutrients for plants to grow without soil!

2. Plants

Leafy greens and herbs (like lettuce and basil) are well-adapted to growing in aquaponics system because they don't require a lot of nutritional input to thrive.

3. Bacteria

These naturally-occurring bacteria act as a "biological filter" that breaks down the ammonia from fish waste into nitrites and nitrates (essential nutrients for plant growth).

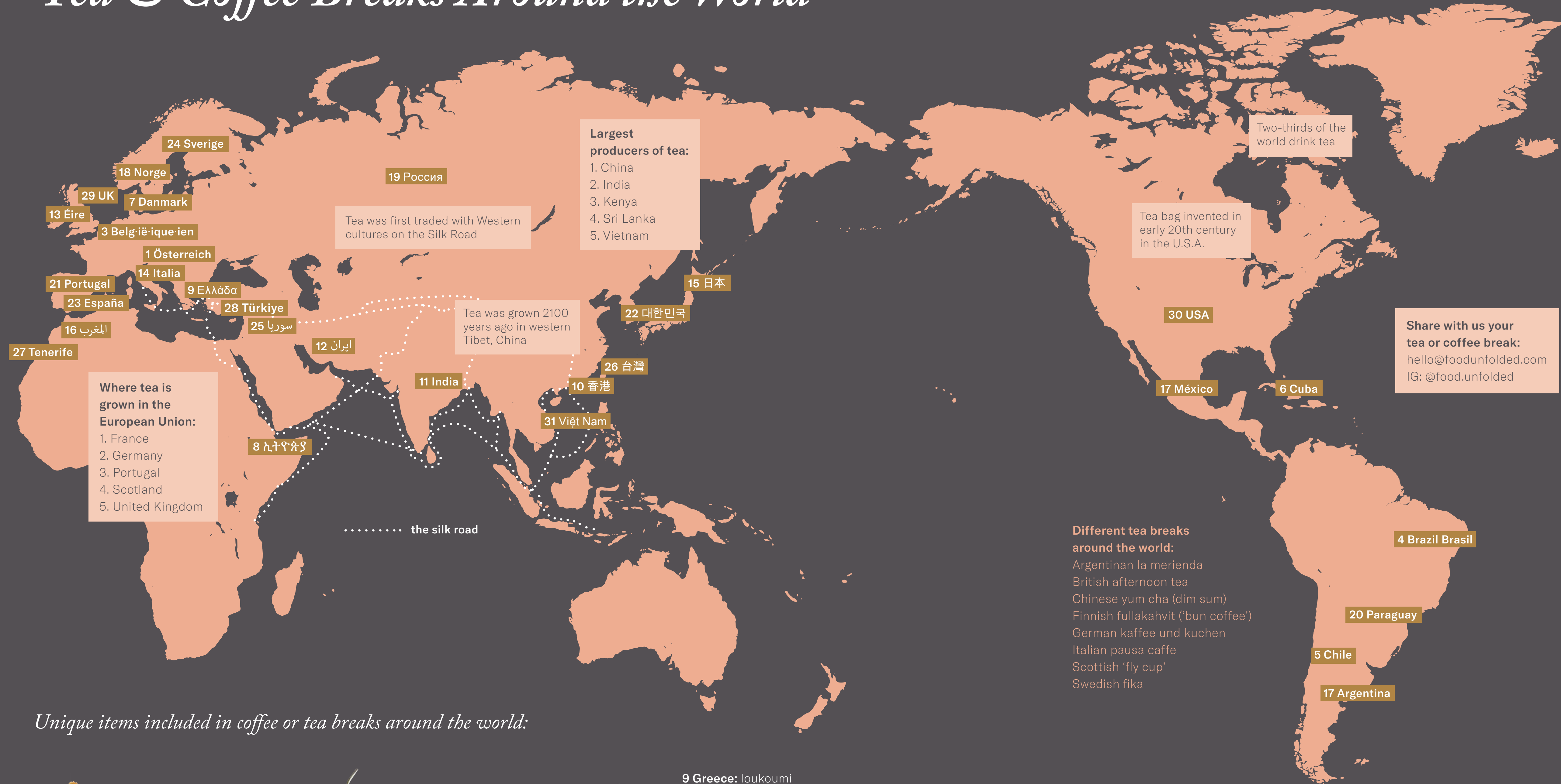


So, aquaponics is actually a symbiotic arrangement where fish, bacteria and plants are able to mutually benefit while providing for each other.

茶 *Chá*

Chinese character for **tea**, pronounced as 'cha'. The art of drinking tea has been around for millennia, originating in Ancient China. Here's a map, showing a handful of tea and coffee breaks around the world.

Tea & Coffee Breaks Around the World



Unique items included in coffee or tea breaks around the world:


1 Argentina: submarine con churros or toastas (toast)


2 Austria: Wiener melange, (similar to cappuccino), with sachertorte (chocolate cake)


3 Belgium: speculoos or praline chocolate


4 Brazil: corn cake or pao de queijo (cheese bread)


5 Chile: yerba mate


6 Cuba: plátanos maduros (fried sweet plantains)


7 Denmark: brunsviger


8 Ethiopia: Ethiopian coffee and popcorn


9 Greece: loukoumi or smyrneika cookies dipped in Greek coffee

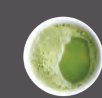

10 Hong Kong: tea with condensed milk


11 India: chai, samosa or idli (rice cake)


12 Iran: bamieh pastries (Perisan rosewater doughnuts)


13 Ireland: Rich tea biscuits with black tea (with sugar and milk)


14 Italy: biscuits or pasticcini with espresso


15 Japan: matcha tea with pastry


16 Morocco: mint tea with msemmen (pancake)


17 Mexico: Pan dulces or conchas


18 Norway: lefse, tebrød, bolle (skillingsbolle, skoleboller)


19 Russia: tea with lemon, accompanied with jam, cakes, cookies, sweets


20 Paraguay: tereré (iced yerba mate)


21 Portugal: pastel de nata (custard tart)


22 South Korea: rice cakes with tea


23 Spain: café con hielo (coffee with ice)


24 Sweden: kanelbullar (cinnamon buns) or rulltårta (roll cake)


25 Syria: dark coffee or black tea with dates


26 Taiwan: 紅豆餅 (red bean 'cart wheel' pancake), bubble tea


27 Tenerife, Spain: barraquito (coffee, condensed milk, Cointreau, cinnamon, lemon)


28 Turkey: Turkish coffee and delight


29 UK: scones and biscuits

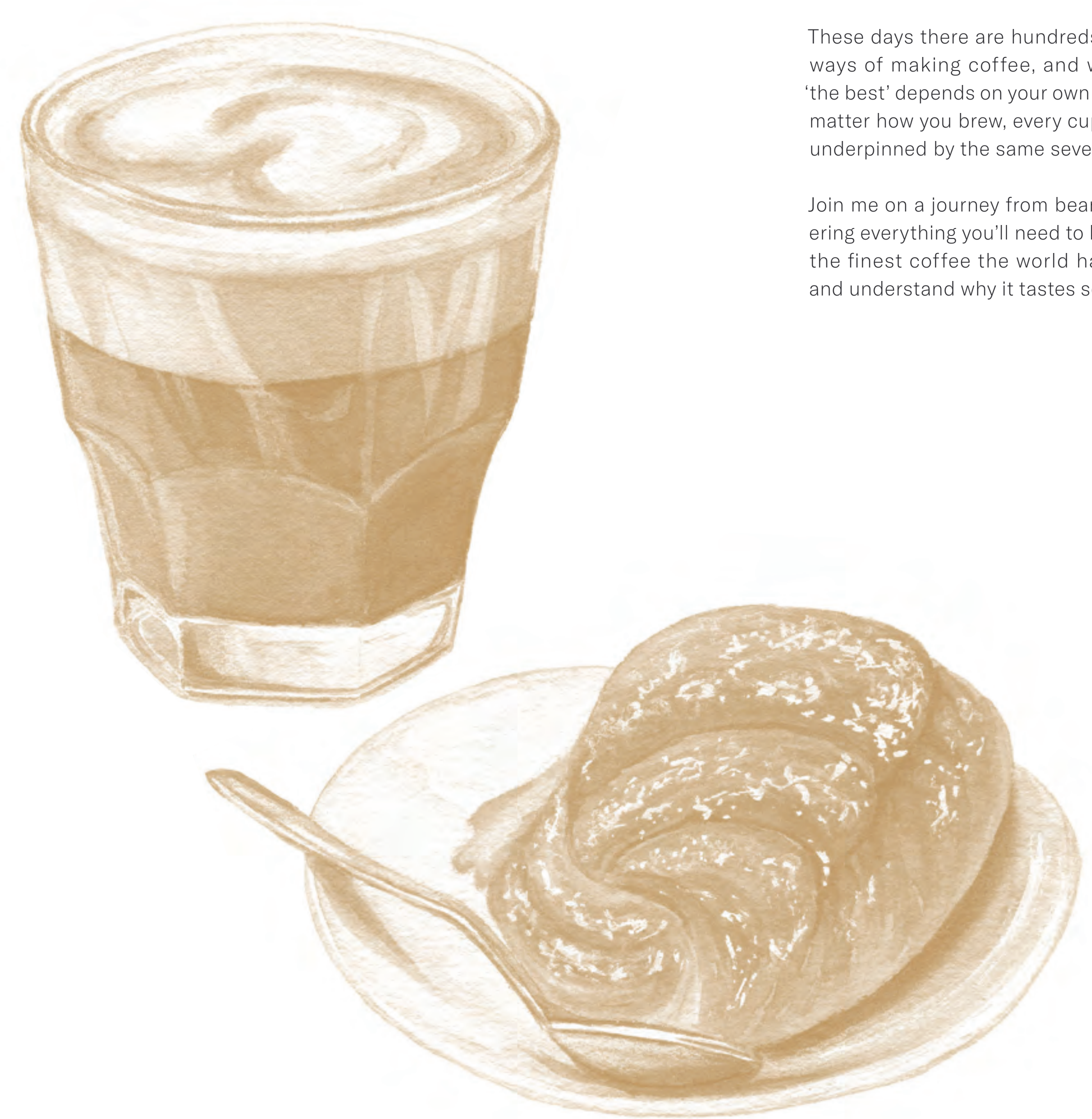

30 USA: bagels, donuts or pie


31 Vietnam: Vietnamese coffee with condensed milk

ARAN SHAUNAK

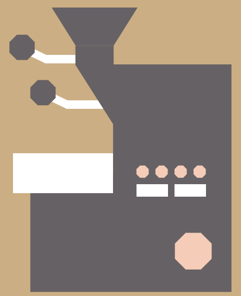
Coffee Brewing The Science Behind the Make & Taste

There are hundreds of ways of making a coffee, and everyone thinks theirs is the best. But is there a scientifically 'perfect' coffee?



These days there are hundreds of different ways of making coffee, and which cup is 'the best' depends on your own taste. But no matter how you brew, every cup of coffee is underpinned by the same seven key steps.

Join me on a journey from bean to cup, covering everything you'll need to know to brew the finest coffee the world has ever seen and understand why it tastes so damn good.



Step 1: buy hand-picked 100% arabica beans

First things first – you can't make a great coffee with the wrong ingredients.

There are two major species of commercial coffee plants in the world: *Coffea arabica* and *Coffea robusta*. Robusta beans are easier to grow and cheaper to buy, but Arabica beans are widely considered to make better tasting coffee (hence why most high-street coffee chains proudly boast that their coffee is 100% Arabica).

One reason for this is that Robusta beans contain more caffeine. Whilst that might sound like a good thing, lots of caffeine actually makes coffee taste harsh and bitter. Arabica beans contain less caffeine and more fat-based compounds, which make coffee taste smooth and rich.

It's not just the species of coffee bean that matters though: how a bean is grown and harvested matters too. Even Arabica beans contain loads of those harsh chemicals before they ripen, so even if there's only a few under-ripe beans in a batch (which inevitably happens when you harvest an entire crop at once with a machine) it can really ruin the taste of your final brew.

Step 2: Roast your beans at 200˚C

Before roasting, coffee beans are actually green, and they contain a high concentration of molecules which both smell and taste unpleasant (like trigonelline, chlorogenic acids and aldehydes).

Roasting coffee beans at high temperatures (around 200°C) breaks down most of these molecules. The high heat drives other reactions that replace the unpleasant molecules with so-called 'aromatic' molecules. Roasting coffee beans for longer and at a higher temperature (a darker roast) means the amino acids and sugars inside the beans will have more time to react with one another, creating more of these delicious aromatic comp-ounds and breaking down more unpleasant compounds will be broken down, which gives a deep rich taste to the final brew. But, don't roast your beans for too long. When roasting high-quality coffee beans, a dark roast can overpower the delicate flavours some connoisseurs are searching for, so a shorter, lighter roast can be the way forward. Even worse, if your beans stay in the oven long enough to reach a toasty 250°C they'll crack in half, and all the flavour you've created will evaporate away.

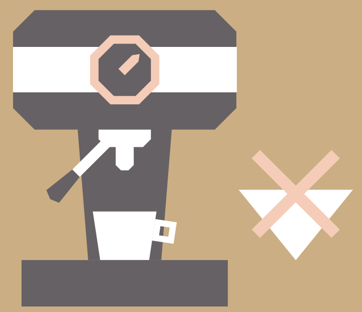
Step 3: Grind it fine and fresh

Grinding beans into a powder increases the surface area of your coffee beans. This helps the flavour locked inside your beans to escape. How you grind your coffee determines how long you should brew it for: finely ground coffee has a higher surface area, so you'll pull out flavour more quickly. But, it's also easier to burn or over-brew a finely ground coffee, giving you lots of bitter compounds that can ruin the richer flavours.

It's also key to use the right grind for your chosen method of brewing. For example, using an espresso machine that makes coffee in <1 min means we need to use a fine grind or else the coffee won't have enough time to brew and will come out watery and tasteless.

“Coffee changes as you move these pieces around, and the perfect coffee is different for everyone.”

– Frederick Gonzalez, Master barista



Step 4: The tech – Use an espresso machine

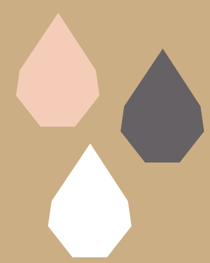
Now we can finally get down to actually making our coffee. But how?

There's never been just one way of doing it: you could use an espresso machine, a French press, or a complex contraption, which looks like it belongs in a lab rather than your kitchen. But no matter what method you use, brewing a coffee can be broken down into a few simple variables:

1. How coarse or fine you grind your coffee beans,
2. The water you use, and
3. What temperature and for how long you brew it.

But remember, avoid paper filters! Most of the tastiest compounds in coffee are fat-based, which means they'll end up stuck to the filter paper rather than in your cup.

If you're brewing coffee at home, your best bet is to ignore all the complex new technologies and just stick with a traditional espresso machine, brew your coffee under pressure rather than using a filter, and focus on getting everything else just right.

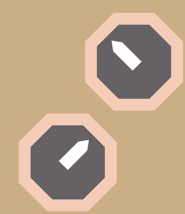


Step 5: Use hot water (92-96˚C)

Water makes up 99% of a cup of coffee, so if you want the perfect warm cup of coffee, treat the water you use with the respect it deserves. First: Use hot water between 92-96°C. Any hotter and it will burn your coffee and ruin the taste. Any colder and you won't extract enough of those aromatic compounds, leaving you with a cup of brown water.

Second: Use 'hard' tap water. Hard water contains lots of calcium and magnesium ions, which stick to the molecules we want, bringing out more flavour from your coffee.

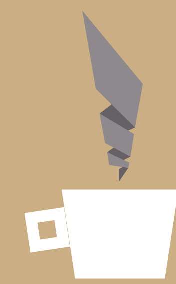
Lastly: Use the right amount of water. Too much will dilute the flavour you've worked so hard to get hold of. Too little, and you won't actually have any coffee to drink. For an esp-resso, weigh your coffee and measure out 15ml of water for every 1g of coffee you're using. It might sound pedantic, but just think of it as a science experiment.



Step 6: Drop the pressure & take your time

So our brewing has begun – but when does it end? Striking a balance between flavour and bitterness is far from easy. The very first compounds extracted from coffee are acidic and horrible, but leaving coffee brewing for too long increases the risk of burning it and leaves you with more bitter compounds which overpower any other flavours.

The brewing time all depends on what pressure we set our machine to. The higher the pressure, the faster water flows through the coffee, so the less time we need to leave it. Traditionally, coffee shops (and most consumer espresso machines) make an espresso under ~9 bars of pressure (which takes around 20-30 seconds), but some experts argue that brewing at a lower pressure (7-8 bars) for a little longer extracts a little bit more of that sweet spot of rich espresso goodness.



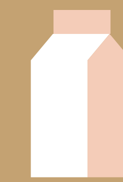
Step 7: Drink it while it's hot

We've made it: a handcrafted cup of precision and perfection (unless you like your coffee with milk, in which case jump to the bonus step below). All that's left now is to enjoy the taste of your perfect cup, just remember one more thing though: drink it while it's hot (unless you prefer cold brew).

What we call 'flavour' is much more than just how things taste: the texture, temperature and smell of food also contributes to its flavour, which is why a blocked nose stops you tasting much at all. In a hot coffee, all those rich, creamy flavours will evaporate off your tongue and reach your nose, creating the true full-bodied flavour we're aiming for.

Last but not least, experiment. Master barista Frederick Gonzalez says:

“Coffee changes as you move these pieces around, and the perfect coffee is different for everyone. If you want to delve deeper, there's plenty of people out there who'd love to get you hooked–check out Standart Magazine, Barista Magazine, The Daily Grind and Coffee Talk for starters!”



Bonus Step: Add steamed full-fat milk or Milk Alternative

'Latte art' takes practice and dedication to get right, but there's also a science behind why we froth milk before adding it to our coffee. Adding warm milk helps keep your coffee warm, but heating up milk also breaks down some of its lactose into other sugars (like glucose) which make it taste much sweeter. To get the taste just right, steam your milk to around 60°C, but don't overdo it – any hotter and it'll curdle.

Steaming milk also creates a 'microfoam': a foam so fine and creamy that you can't even see the individual bubbles. As you steam milk, its proteins stick to air bubbles and stop them from bursting, while milk fats try and pop all these bubbles. This means its way easier to create a strong and stable milk foam with low-fat milk, but it also means it'll have lots of really large bubbles in it.

If you want a true microfoam, you need more fat around to pop everything but the smallest bubbles, so it's best to struggle on with full-fat milk. Traditionally that meant cow's milk was your only option (as alternative milks are very low in fat), but vegans, you're in luck: 'barista' edition milk alternatives have lots of added unsaturated fat, so it foams up almost as well as the real deal.

For the full article and references, see foodunfolded.co/coffee.

RECIPE

Sweet Poached Pears with Chestnut Cream & Lemon Balm Meringue

By Pieter-Jan Lint,
Plant-based Chef

In our kitchen we strongly believe in working with local ingredients, but we also try to think outside of the box when it comes to cooking with them. It seems to me that vegan pastry is a rather difficult task for many, but if you allow me, you will see that these recipes are easy to follow. The basic ingredients for these recipes are locally sourced and easy to find in Belgium. Because I like to bring people close to nature, it's advisable to visit your own garden, nearby forest or community garden where you can find the chestnuts and the lemon balm. The recipes combined form an entire dessert, as you can see in the photo, but you can also make them individually and integrate them in your personal style of cooking. I wish you a lot of fun and a tasty dessert in the end!

Pieter-Jan

CHESTNUT 'CRÈMEUX'

Chestnuts	400 g
Oat milk	275 ml
Maple syrup	180 ml
Unprocessed coconut oil	150 g
Pinch of salt	
Lemon Juice	20g

TO MAKE THE CHESTNUT 'CRÈMEUX':

Roast the chestnuts in a pan on high heat (just a few minutes), and peel of the outer layer.

Roast the peeled chestnuts on a baking tray in the oven for about 10 minutes. Set aside and let cool down as you prepare the other ingredients.

In a high-speed blender: add the roasted chestnuts, the lemon juice, maple syrup, oat milk and salt. Blend until smooth.

Add the coconut oil and blend until the cream has a nice smooth consistency.

Scoop the 'crèmeux' in a piping bag and allow to stiffen for about 3 hours in the fridge.

You can also fill silicon moulds to create a personal touch.

POACHED PEARS

Cane sugar	250 g
Water	250 ml
Juice of a half lemon	
5 pods of cardamom (crushed)	
1 cinnamon stick	
4 semi-ripe pears	

TO MAKE THE SYRUP:

Add water, cane sugar, cardamom, cinnamon and lemon juice in a cooking pot and bring to a simmer.

TO MAKE THE PEARS:

Cut the pears in parts and remove the pits. You can peal them if you want, but I don't think that's necessary.

Add the pears to the warm syrup and cook on low heat for a few minutes.

Let the pears cool down in the syrup.

LEMON BALM MERINGUE

Aquafaba (cooking broth from canned chickpeas)	200 g
Cane sugar	350 g
1 spoon of finely chopped lemon balm	

TO MAKE THE LEMON BALM MERINGUE:

In a blender, blend cane sugar till it becomes powdered sugar.

In a stand mixer, whisk the aquafaba until firm.
Then add the powdered cane sugar bit by bit and wait patiently until the meringue has firm and stiff peaks.

Add the finely chopped lemon balm.
Scoop the meringue in a piping bag.

Pipe nice tufts of meringue on baking paper.

Place in the oven for 4 hours at 90°C and ensure that the excess moisture can leave the oven. You can do this by placing a spoon between the oven door so that it is always slightly ajar.

Allow to cool and keep in a dry box before use.

Chickpeas Quick Facts

One of our favourite beans. Well, actually it is a legume. And to be scientifically correct, it is part of the Fabaceae family, in the subfamily Faboideae called Cicer arietinum.

ORIGINS OF CHICKPEAS
Chickpeas were domesticated about 9,000 B.C.E. They originally came from the Mediterranean basin.

RINSE YOUR CHICKPEAS
No matter how you process the canned or dried chickpeas, always remember to rinse them properly before use—otherwise they can produce quite a sum of gas in your gut (what a bummer, I know!). A big nutritional bonus is that chickpeas are also full of folate, fibre and proteins.

TWO TYPES OF CHICKPEAS
There are two groups of chickpeas that are cultivated across the globe. There is the Kabuli group and Desi group. One of the main differences is their appearance, the Desi type being darker and smaller and the Kabuli being bigger and lighter in colour. Comparing nutrition values, the Kabuli type has less fibre than Desi.

BONUS FACTS
The chickpeas' pods produce oxalic and malic acids that prevent insects from eating them.

These acids were also used as ingredients for medicines in India for treatments like cholera, constipation, warts, bronchitis, and were even used as aphrodisiacs.

Erþō

Proto-Germanic meaning ‘**earth**’ or ‘**ground**’. Much of our food comes from the earth, sprouting from the ground. Flip the page and learn some traditional and modern ways of farming.

PHOTOGRAPH: KIRSTYN BYRNE

SAMANTA OON

Rice in Asia How it's Grown

Rice is a popular grain in traditional and modern cuisines around the world. So, what's the process to get it from the paddy fields to your plate?

"I cannot live without rice" – my mum has said this to me on more than one occasion. Perhaps that's a tad exaggerated, but many people might actually agree with her because rice is a staple food for more than half the global population. You might have had it in sushi, with curry, or even baked into pudding. So, what do these grains go through before they end up in our favourite dishes?

A BITE OF HISTORY

The lion's share of rice is still consumed in Asian countries, but this staple grain also plays a feature role in several traditional European dishes and has gained popularity over time. The cultural significance of rice is found in culinary traditions like *risotto* in Italy, *paella* in Spain, and *riz au lait* in France. Alexander the Great is credited with bringing rice to Greece after his military expedition through Asia around 320 BCE, while the Moors are believed to have introduced Asian rice (also known as *Oryza sativa*) to the Iberian Peninsula. Today, Italy is the leading producer of this grain in Europe, but different varieties of rice are still grown in certain parts of Greece and Spain.

HOW IS RICE PRODUCED IN ASIA?

While rice is a versatile crop that can be grown in a variety of environments, 90% of the global rice supply is produced in tropical nations with high rainfall such as Thailand, India and Indonesia. Rice crops require a large amount of water to grow, so most farmers choose to flood their paddy fields at all times with a layer of water around 3-10 centimetres in height. In the tropics where there are seasons of heavy rainfall, the water for paddy fields often come from irrigation systems that are linked to nearby dams and rivers.

Pests and diseases are a frequent nuisance in paddy fields, as an estimated 37% of rice crops are lost each year to insects and birds. Thus, to supply the sheer amount of rice produced each year, farmers have to use fertiliser and spray pesticides to keep rice seedlings healthy and pest-free. Even though organic rice is considered more desirable in the European market, growing rice without fertiliser or pesticides yields less rice and is subsequently less profitable for farmers who rely on these crops for their livelihoods.

When rice seedlings have matured and their kernels have turned a golden brown, the harvesting can begin. First, the crops are cut and then threshed to remove the actual grains from the harvested material. All the collected grains are then put through a drying process as soon as possible to get rid of most of the moisture in the rice, which can be done manually by drying the grains under the sun or by using mechanical dryers. A crucial step in rice production is milling when the husk and bran layers that encase a rice kernel are removed to make the rice edible.

THE FUTURE OF RICE PRODUCTION

A pressing concern for rice farmers is climate change and the increasing frequency of droughts that can have a devastating impact on rice production. Ironically, growing rice in flooded fields releases methane—a greenhouse gas that contributes to global warming. When paddy fields are flooded, the layer of water prevents oxygen from reaching the soil and anaerobic bacteria can then thrive in the soil layer while producing methane gas. What all this means is that the conventional way of growing rice is becoming unsustainable.

Luckily, researchers and farmers are testing out new ways to grow rice, such as the system of rice intensification (SRI) that involves alternately wetting and drying rice plants, and ultimately uses half the water that constant flooding does. This technique also requires fewer seeds and uses organic matter for fertiliser while increasing total rice yield by 20-200%. Yet more scientists are looking to breed extra resilient types of rice like Green Super Rice (GSR) that can withstand harsh environments in floods, droughts or salty soils. So if you're a big fan of rice, then don't worry because the future of your favourite complex carb is in good hands.

For the full article, see foodunfolded.co/riceinasia.

FUN FACT:

Have you ever wondered what the difference between brown and white rice is? Well, you get brown rice when only the husk is removed from the kernel, whereas kernels that are further milled or polished to discard both the bran and husk layers end up as white rice. You may have also heard of red and black rice–they're just varieties of rice with some extra pigments called anthocyanin in their bran layer.

Rice, The Italian Way

I don't love risotto. This has always been, for my Italian family, one of my most intriguing quirks. This oddity soon became a source of indignation when my grandma found out that despite my distaste for risotto, I still loved sticky sushi rice and basmati rice in a soupy curry. You see, Italians care about their rice. But what is so special about the Italian way of growing and cooking it?

THE SECRET GRAINS BEHIND A GOOD RISOTTO

'Risotto' is not just a recipe. It's part of Italy's national heritage, and a significant product in the Italian economy. Italy produces around 1.3 million tonnes of rice each year, 53% of which are exported to other European countries.

There is, however, one very special grain that Italians don't export much, but rather keep for themselves: the so-called "Lungo A" ("Long A") grain. This broad category includes Carnaroli, Arborio, Baldo, S. Andrea, and Volano. These are the most suitable kinds of rice to cook the perfect risotto. It is no secret that Italians religiously adhere to their culinary rules–so if you dare to cook risotto with Basmati rice in front of an Italian, be prepared to be scolded about your outrageously inaccurate cooking skills.

There is a good reason to consider Long A, and in particular Carnaroli, as the caviar of risotto rice: it all boils down to starch. In order to obtain the creamy texture of risotto, you need a grain that will be high in amylopectin (starch) content. Cooking risotto means continuously stirring the rice in the pot, and the reason for this tedious practice is that the stirring rubs starch off the surface of rice. This dissolution of starch thickens the cooking liquid, allowing it to achieve the hallmark texture of the notorious dish.

HOW ITALIAN RICE IS GROWN

Italian rice fields are located in a large plain, Pianura Padana, equidistant from the Alps and the Mediterranean Sea. In the summer, when water melts from the Alps glaciers, covering the fields, these expanses almost look like an immense mirror. The journey from the field to the table is a short one.

"Rice is a product that comes from the field to the table after only a cleaning operation," explains Roberto Magnaghi, director general of the Ente Risi, the Italian national institution for rice. Rice farmers buy seeds, sow them, grow them, and then sell them to the rice mill that will transform them.

During transformation, the external shell (or "husk") covering of the grain is rubbed off—since it contains inedible silicon—resulting in wholegrain rice. Further scratching to the surface of the rice yields white rice. If, after the removal of the husk, the grain is instead soaked and then quickly dried, the result

HISTORY BRIEF: RENAISSANCE RICE

Some may be interested in why Italy grew to become the most prominent rice producer in Europe. The first answer is that it has been cultivating rice for a long time. Lombardy, Piedmont, and Veneto—the Italian regions that host most rice fields today—were already considerably developed in their cultivation of this grain by the end of the 15th century. By that time, several traders were already specialised in exporting rice to Switzerland. However, until the 1850s, the only variety grown in Italy was known as "Nostrale." The modern cultivation of rice, with all of its different varieties, is owed to a Jesuit Priest named Calleri—a missionary who travelled to the Philippines and, upon returning to Italy in 1839, illegally brought back 43 different varieties of rice seeds. This event, together with agrarian policies that led to the establishment of an efficient and extensive irrigation system, marked the beginning of modern Italian rice production.

is parboiled rice. Taste-wise, parboiled rice absorbs less flavours from condiments—it is better used in salads or as a side. That's also why Italians patronisingly relegate it to 'canteen food'.

BREAKING TRADITIONS WITH NEW TECHNOLOGIES

In the last century, Italian rice farmers have honed their techniques to increase production and save resources. For example, until the 1960s, about 50% of rice crops were transplanted—meaning that rice seeds were activated in a nursery, and once the plants reached a suitable age for uprooting, they were removed and planted in the fields.

This technique is now completely abandoned in Italy: farmers plant directly in the field, saving time and labour; transplantation is only performed as corrective work in small portions of land, and some farmers have been experimenting with mechanical transplant in their crops. In countries like China, however, this technique is still the most adopted.

However, the introduction of new technologies has allowed Italian farmers to maintain the health of each plant regardless of weather, pests, and soil quality, making this tedious practice obsolete. Ente Risi is leading the way in the implementation of precision technology to ensure farmers apply the exact dose of fertiliser to each small plot of land.

We can imagine 'precision agriculture' as the plants' version of 'precision medicine'. Drones measure the 'vigour' of each plant (meaning the health of the plant; how well the plant is doing) and farmers apply fertilisers accordingly. Thanks to precision agriculture, farmers will be increasingly able to both protect the environment and maximise their production.

SAVING WATER OR SAVING THE PLANET?

The second answer to why Italy is such an important rice producer in Europe has to do with its geography. Irrigation is easy in the rice growing regions of Italy. The large plains located between the Alps and the Mediterranean Sea allow for an effective system of irrigation by submersion. When the summer period starts, water melts from the Alps' glaciers, reaching the Pianura Padana. The water is stocked there for a few months, from April to September, thanks to artificially constructed embankments. Once the rice fields have been flooded and rice has grown, the water is then released and returns to the sea.

The submersion technique, however, is not all sunshine and rainbows. It is also known to be a major contributor to climate change, and recent research suggests it is a far bigger problem than we previously thought. It's a double-edged sword: submersion lowers water use, but it boosts greenhouse gases. Marco Romani, Director of the Research Centre at Ente Risi, explained that through submersion, rice farmers can annually save about 4,000-4,500 m³ of water per hectare that would otherwise be lost to the atmosphere. However, submersion also releases (in the short term) the same amount of carbon as 1,200 coal power plants. Even though flooding fields intermittently could help cut the release of methane, it also produces up to 45 times more nitrous oxide.

Italy is yet to adopt a solution to this pressing issue—even if I'm not risotto's biggest fan, deep down I hope the country will find a way to save both the Earth and Carnaroli.

For the full article, see foodunfolded.co/italianrice.

"It's a double-edged sword: submersion lowers water use, but it boosts greenhouse gases."

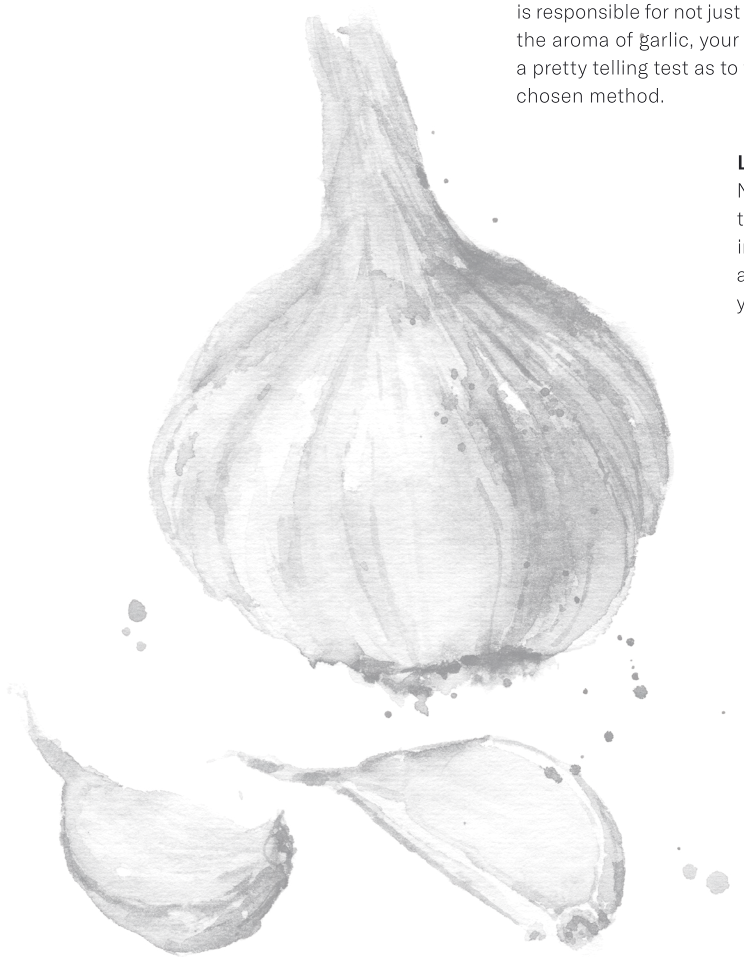
LOTTIE BINGHAM

The Science Behind Garlic's Aroma

Garlic contains more than 200 potentially bioactive molecules, but one compound in particular, *allicin*, has been heavily credited for both the herb's remarkable medicinal properties as well as it's tantalising taste.

Surprisingly, however, a raw bulb of garlic contains next to no allicin whatsoever; allicin is produced only when the bulb suffers from tissue damage (e.g. incurred through the process of chopping). Given that allicin only comes from damage to the cells, to obtain the most allicin, you need to inflict the most damage and least-laborious method would be to zest or grate your garlic. Given that allicin is responsible for not just the flavour, but also the aroma of garlic, your olfactory system is a pretty telling test as to the efficacy of your chosen method.

Leave your garlic alone
Numerous studies have found that you can get the most goodness out of your allicin by leaving the prepared garlic for 10 minutes–so just as you would let a good wine breathe, leave your garlic to rest before adding it to the pan.



MEGHAN HORVATH

Vertical Farming What's the deal anyway?

The word farming evokes a range of sentiments. For me, I see images of the sun shining on green, open fields with animals grazing about. Can the same be said when you instead hear vertical farming?

WHAT IS VERTICAL FARMING?
First invented in 1915 by American geologist Gilbert Ellis Bailey, the initial concept of vertical farming was rather understood as a sort of rooftop farming. The definition evolved as vertical farming moved indoors, and while definitions vary, most agree that vertical farming refers to the growing of edible greens in stacked rows in a controlled environment.

Vertical farming often falls in line with 'indoor farming', 'urban agriculture' and 'controlled-environment agriculture' (which also encompasses greenhouse cultivation), but the concept remains unique. With vertical farming, the growing takes place where factors such as temperature, nutrients, lighting, irrigation, and air circulation are constantly monitored and adjusted.

IS IT MORE SUSTAINABLE?
While there is not yet an end-all, single solution to creating a more sustainable food system, introducing vertical farming practices in urban centres may offer a complementary system to traditional farming, with more sustainable aspects.

Vertical farming's reduced use of water and land, and decreased waste and CO_2 emissions could already be helpful in mitigating climate change were it to become more widely explored. The controlled and contained nature of the technology could reduce agricultural runoff as well.

Added to that, proponents of the technology claim that it makes crops less susceptible to pests and diseases without the use of pesticides since food is grown in a controlled environment. This type of agriculture also provides ideal circumstances for growing plants in all climates, locations, and seasons, and allows crops to be nutrient dense since factors influencing quality can be carefully tailored and controlled.

There are many critics of vertical farming who argue against the large amount of energy needed to produce large crops, whereas the sun is free. Therefore, at the moment, the best way of thinking of vertical farming is probably as a technology which would be complementary to traditional farming techniques.

FEEDING URBAN COMMUNITIES
Given that vertical farming technology can work anywhere, parts of the food system would be less dependent on transport from rural areas to urban centres, thereby decreasing some of our fuel emissions. Food waste by spoilage could also be reduced considering there would be little time spent between when crops would be harvested and sold to us (the consumers).

The process of vertical farming also uses a fraction of the land and water required for conventional farming, again due to the carefully controlled environment in which the crops grow. Foods can be grown in warehouses in cities, in produce departments of local supermarkets, in restaurant kitchens and even in microwave-sized models in home kitchens.

Growing food where we live also means harvesting at the peak level of ripeness and nutritional value. By the year 2030, an anticipated 60% of people will be living within cities, making urban agriculture an attractive technique for feeding parts of our growing population while protecting our environment, as well as offering a way of enabling our urban population to reconnect with how our food is produced.

For the full article, see foodunfolded.co/verticalfarming.

KELLY OAKES

Urban Farming Making Food More Sustainable

When we think of farming, we imagine rural landscapes with huge fields extending as far as the eye can see. For the most part that's true, but it's not the only way: urban farming in and around cities is on the rise.

WHAT IS URBAN FARMING?

Urban farming is an umbrella term that covers all sorts of farming in and near cities, including growing plants and raising livestock. From growing salad leaves in disused railway arches or herbs inside supermarkets, to people growing tomatoes on their balconies or keeping chickens in their backyard, urban farming can take many different forms.

In Berlin, for example, one company grows herbs and salad leaves right inside supermarkets and restaurants, cutting down the miles that food has to travel to reach you to zero. And in London, rooftops are used by beekeepers to produce honey specific to indiv-idual postcodes that is sold in shops throughout the city.

While all forms of urban farming come with challenges, they also bring benefits that can help make our food systems more sustainable. A 2007 report by the Food and Agriculture Organisation (FAO) for the UN says that, on the whole, urban farming complements rural agriculture, and helps increase the efficiency of national food systems.

THE BENEFITS OF URBAN FARMING

With ⅔ of the world's population expected to be living in cities by 2050, it makes sense to grow food closer to where people will actually eat it. Researchers estimate that if cities around the world took full advantage of opportunities for urban agriculture, we could produce as much as 180 million metric tonnes of food a year—just from urban farms alone.

Though it's unlikely that any city would be able to produce enough food to entirely sustain itself, the practice also has plenty of other benefits: adding greenery to otherwise grey urban landscapes, helping us cut down on food waste because there's less chance of crops going bad while in transit, and creating jobs in cities.

One of the other big advantages is that growing locally reduces food miles. But while cutting food miles is an admirable aim, transportation only accounts for a small percentage of carbon emissions from the food we eat, so food grown in your city doesn't necessarily have a smaller carbon footprint than food that's shipped in from further afield.

INDOOR FARMING: INCREASING FOOD SECURITY

High-tech indoor growing systems designed specifically for indoor urban farming mean that we can produce fresh food year-round, not having to rely on the weather outside, which is a good thing for food security as climate change brings more extreme weather events.

But while outdoor and rooftop farms can make use of natural sunlight, indoor farms need electricity to power artificial lights and grow their crops, increasing their environmental footprint. But technology can help keep this footprint to a minimum: for example, instead of mimicking the full spectrum of sunlight, indoor farms often use pink LEDs that include only the red and blue wavelengths of light that plants actually need to stimulate growth, using less energy.

Another big challenge facing companies setting up farms in cities is the cost of land. High land costs can lead to high prices, which means produce would only available to those who can pay the most, not poorer communities who are most in need of affordable fresh food.

WHAT FRUIT AND VEG IS EASY TO GROW ON A TERRACE?

If you live in a city, you can start urban farming too, and you don't need lots of technology to get started! All you need is a terrace, a balcony, or even just a windowsill. Once you get the hang of it, you could be producing a serious amount of food. The FAO estimates that a garden plot one square metre in size can produce 20kg of produce each year–equivalent to around 160 tomatoes, or 18 cabbages.

It's best to start small and grow food you know you like to eat. Tomatoes and chillies do well on balconies, and herbs like rosemary, thyme, and sage will cope there too. If your garden doesn't have room for a full vegetable plot, beetroot, broad beans and carrots will grow well in containers. And if you only have a sunny windowsill to play with, basil will appreciate being inside sheltered from the wind.

For the full article, see foodunfolded.co/urbanfarming.

MADHURA RAO

Are organic foods really chemical free?

Residue of chemicals in food is a side-effect of industrialised agriculture. Organic farming seeks to produce food that is free from such residues, but is it really possible to grow chemical-free food?

WHAT IS ORGANIC FOOD?

There is no single, universally accepted definition of organic food or organic farming. But in general, policies and legislation around organic farming strive to conserve biodiversity, recycle resources on the farm, and bring about ecological balance. Most countries have their own legislation to precisely define what is permitted on an organic farm and what is not. However, a common requirement for organic farming around the world is restricted use of synthetic chemicals.

WHY ARE SYNTHETIC CHEMICALS RESTRICTED ON ORGANIC FARMS?

Throughout the history of agriculture, farmers have used the chemical properties of various elements and compounds to improve their crop yields. They are often called 'agrochemicals' and include a broad range of natural and synthetic substances which are used for protecting crops against pests or for enriching the soil. The Green Revolution, an agricultural movement which took place in the 1950s and 1960s, was largely responsible for introducing synthetic agrochemicals in developing countries and intensifying their use in developed countries.

While these chemicals increased crop yield considerably by keeping insects and plant diseases at bay, their unrestrained use resulted in several adverse effects as well. Air and water pollution, reduced natural fertility of soil, death of non-targeted animals and plants, and potentially harmful residues in food are some of the serious consequences of excessive use of agrochemicals. One aim of organic farming is to produce food without creating these negative side-effects. That is why, the use of synthetic chemicals is restricted in organic farming.

HOW DO ORGANIC FARMERS FIGHT PESTS?

In agriculture, pests are any living organisms that negatively affect crops and livestock. They're a little bit like uninvited guests who show up at your party, eat all your food, and then move on to the next party in the neighbourhood. Not cool at all. Therefore, it is important to take measures to keep pests away from farms, and in case they show up, make sure they leave.

Plant protection products (PPPs) are used to protect plants against pest attacks and can be of chemical or biological origin. The biological plant protection products are often called 'organic pesticides' or 'biopesticides'. Organic farmers cannot use PPPs containing synthetic chemicals and must instead focus on preventive measures.

The technique of biological pest control, also known as biocontrol, involving the release of natural pest enemies (such as ladybugs) into the farm is a popular preventive measure. Natural pest repellents like essential oils made from garlic, black pepper, rosemary, and other common herbs are also used. Additionally, plant species that are inherently resilient to pests are preferred. In the EU, certain organic pesticides derived from plants, microorganisms, or minerals are permitted on organic farms.

CAN CONVENTIONAL PESTICIDES STILL END UP IN ORGANIC FOOD?

Unfortunately, yes. Even though organic farmers do not use synthetic pesticides, deposits of agrochemicals in the soil are hard to get rid of. These pesticides can still find their way into your food via indirect sources such as contaminated water and air. Of course, studies comparing levels of pesticide residues in organic and conventional food generally report a lower contamination in organic food.

But chemical contamination doesn't just happen in the field. Some food must be processed before they can be consumed. Food processing generally involves interaction with various chemicals such as preservatives, processing aids, and additives. Packaging material that comes in contact with food can also leach undesirable chemicals into food. Unprocessed organic foods such as vegetables, fruits and whole grains do not have to undergo many intermediate steps during their journey from the farm to your plate. So, they are less likely to come into contact with additional chemicals.

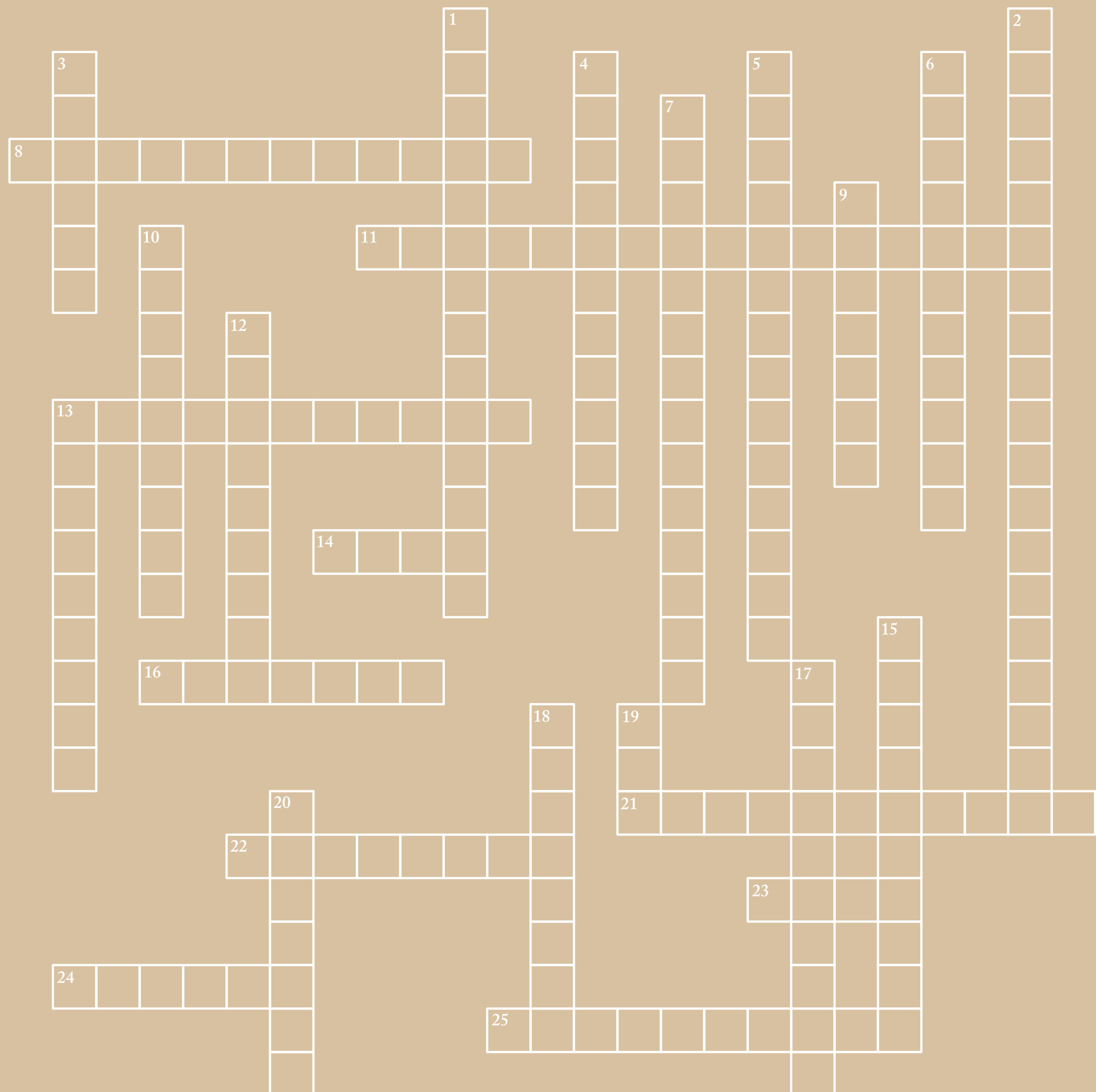
THE BOTTOM LINE

The good news is that food safety legislation establishes what levels of these chemicals are considered acceptable. Any food that is available on the market, organic or non-organic, must comply with these safety regulations. So, in conclusion, any food you eat should not contain unacceptable levels of chemical contaminants but consuming food that has been produced organically helps reduce agrochemical pollution in the environment.

For the full article, please see foodunfolded.co/organicfood.

MARIE LÖDIGE

Crossword



Down

1 This is the idea of making sure that the resources we have keep up with everything else that we're doing, whether that be population growth or advancing in certain areas of technology.
2 The process in which atmospheric carbon dioxide is captured and stored (2 Words: 6, 13)
3 The female reproductive organ of a flower that receives pollen from pollinators (such as bees).
4 Injections administered directly into the layer of skin underneath the epidermis.
5 This is the process of heating food at a mild heat (less than 100 °C) to kill off nasty bacteria.
6 This is when you inject antigenic material into an organism to illicit an immune response, which should in turn make the organism in question immune to the disease in future.
7 This is the area of science which focuses on how we make our food. Speed, cost, safety, taste, fun – these are the big motivators behind making our food better. (2 Words: 4, 10)
9 This is an area of biology which focuses on the interaction between living things and their environment.
10 A popular bread which dough is produced through fermentation.
12 This is a community of living things (birds, plants etc) and non-living things (soil, water etc.).
13 These are chemical substances used to get rid of pesky weeds.
15 A type of fibre that supports the helpful bacteria in our gut.
17 Plant pigments responsible for bright red, yellow and orange hues in many fruits and vegetables.
18 An edible flower that is also said to calm you down and help you sleep.
19 This is the molecule that holds all the genetic code needed to make you. The molecular blueprints of life.
20 One of the building blocks of life which is made from amino-acids.

Across

8 This is the variety of living things within a particular area.
11 A set of reactions between amino acids and sugars, involving heat, that leads foods to become browned. (2 Words: 8,8)
13 A molecule that is attracted to water and dissolves in it easily.
14 It's our most used 'spice' and one of our senses.
16 When liquid flows from more dilute liquid to a less dilute one.
21 Compounds that occur naturally in foods and inhibit a chemical reaction called oxidation.
22 A substance which is usually used in gels for electrophoresis, a technique used to separate molecules based on size, and is most commonly used for DNA molecules.
23 Any living thing that is harmful to our food.
24 These are types of proteins and they go around accelerating chemical reactions in cells, turning one thing into another.
25 These are tiny little microorganisms that you may know as 'the good bacteria'.

ANSWERS PAGE 98

Búkr

Old Norse meaning '**an insect living inside trunks of trees**'. The modern word for *bug* is derived from its Old Norse predecessor, *búkr*. Read on to see how insects are friends, not just foes, to the food we eat today.

How Flies Make Farming More Sustainable

JANE ALICE LIU AND JONATHAN KOPPERT

You've probably heard that eating insects can be a more sustainable alternative for protein. But, maybe you're like me and love seeing sustainable changes, but just can't bring yourself to eat them. Well, you can still have best of both worlds with insects as food for agricultural livestock.

What, is that even a thing? Y-E-S. I was impressed too when I first found out about it! To learn more about how it works, we interviewed Jonathan Koppert, an expert in the insect feed sector. He is the co-founder of Bestico BV, a Dutch company that develops sustainable insect solutions. See what he has to say:

Jane (me): So Jonathan, can you tell us a little bit about insect feed? What is it? And, how is it different from insect food?

Jonathan: Insects as *feed* are just insects that are purposely produced to be food for animals. Insects as *food*, on the other hand, are insects intended to be consumed by people. Although insects are not yet seen as a treat in our western culture, in many other cultures insects are being consumed by people like you and me and a crispy cricket is considered to be a delicacy. In practice, there is not much difference between the two; in both cases the insects need to be safe, clean, healthy, nutritious and delicious.

Jane: I've tried a crispy cricket once, and it really just tasted like chips, but I guess it was healthier since it has more protein than regular potato chips [*laughs*].

I know some animals already eat insects. Can you give us some examples?

Jonathan: In nature, many different species of animals eat insects, like birds and fish. Wild birds love to eat insects because they are nutritious, healthy and yummy for them! And trout and salmon jump out of the water to catch a fly. Actually, the aim of using insects as feed, is to bring back some of this natural diet to farmed animals like chicken and fish.

Jane: But why are insects as feed useful for agriculture? What issues can they help solve?

Jonathan: There are two main global issues which are addressed when considering insects as feed. First is the issue of protein shortages.

"Insects are produced in crates and need much less space and water compared to conventional livestock animals."

Globally, we will need more protein to feed the growing number of people and animals who inhabit our planet. Insects naturally contain a lot of protein and can make a valuable and sustainable contribution towards solving this problem. Secondly, a lot of food which insects could eat is currently underutilized.

For example, food and agricultural waste could be given to these insects to eat, creating more value and less waste. Many different types of industrial by-products and leftover food would make insects really happy.

Jane: That's really an amazing idea for the current sustainability limitations in our agricultural system! Can all insects be used, or are there specific insects used as feed for animals?

Jonathan: Based on EU legislation, there are currently seven different species of insects allowed as feed for animals. The two most important ones are Black Soldier Fly and Mealworms. In both species it is all about the larvae or worms which are considered to be most nutritious and tasty for the animals.

Jane: And what type of insects do Bestico use to feed agricultural livestock?

Jonathan: Bestico has a strong focus on producing the Black Soldier Fly or more precisely, the larvae of the Black Soldier Fly. This species has been selected for its nutritional value, speed of growing cycle and because it's not too picky about what it needs to eat.

Jane: Hm, but aren't flies dirty? I mean, I'm not eating them so that's fine. But couldn't they contaminate production systems? Or somehow affect the livestock eating them?

Jonathan: That's definitely a common misconception. Many people live with the idea that insects and the production of insects is a dirty or not hygienic activity, while in reality, insect production systems need to be clean and hygienic in order to keep these systems free from possible harmful microorganisms. The IPIFF (International Platform of Insect producers for Food and Feed) has even set guidelines for manufacturing principles where great emphasis is placed on hygiene in production. Besides that, local food safety authorities control insect companies on their compliance with European legislation on food and feed safety.

Jane: Okay, *phew*, that's good to know! So then how is insect feed currently produced?

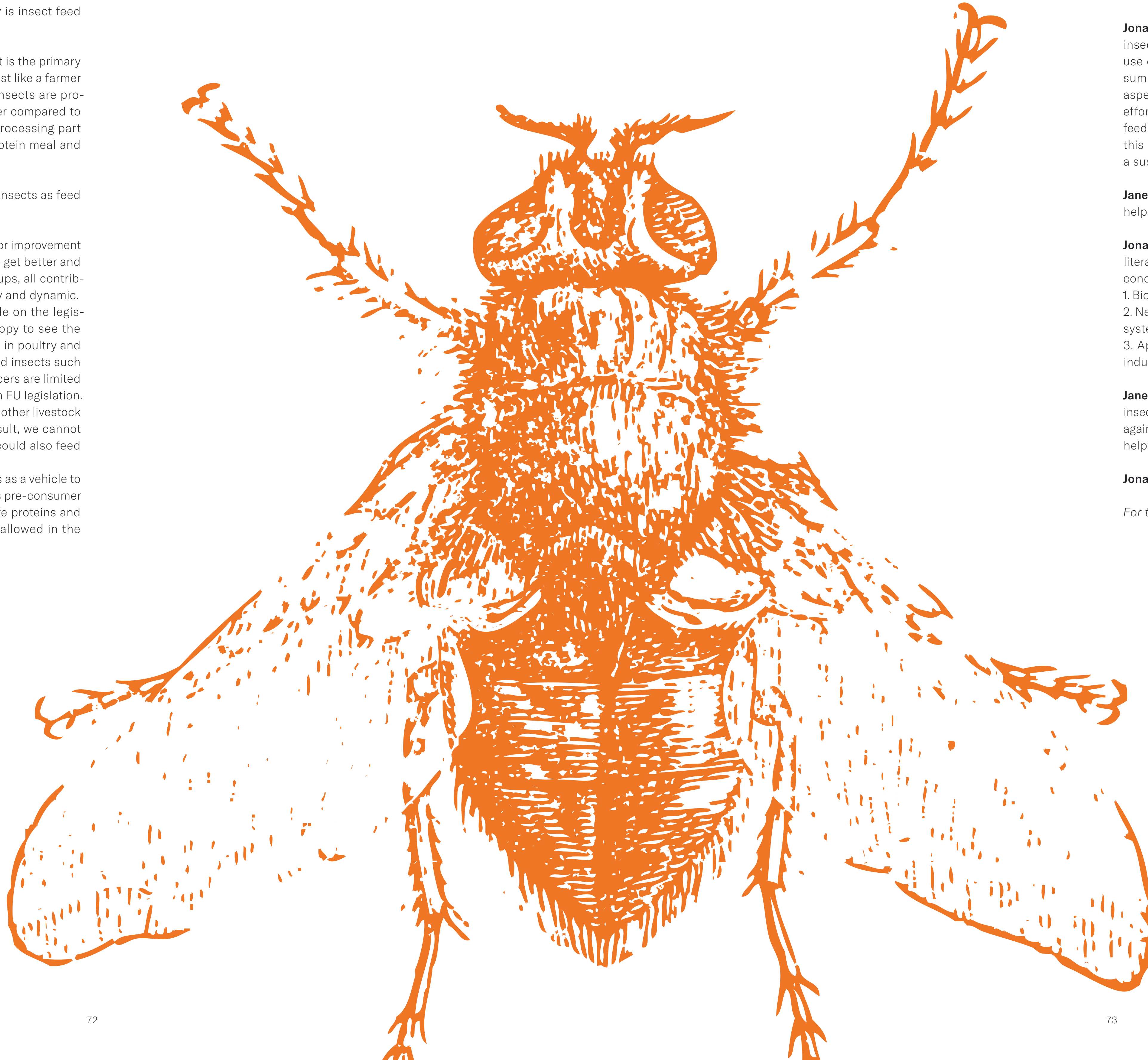
Jonathan: The process is split into two parts. The first is the primary production, where the actual insects are produced (just like a farmer raises his pigs or chickens). The difference is that insects are produced in crates and need much less space and water compared to conventional livestock animals. The second is the processing part where insects are transformed into concentrated protein meal and insect oil.

Jane: Is there any way that the process of producing insects as feed can be improved?

Jonathan: From our perspective there is always room for improvement and we constantly try to reinvent ourselves in order to get better and better. The insect industry knows hundreds of start-ups, all contributing to a better world and keeping our industry lively and dynamic.

For all of us, big improvements can still be made on the legislative aspect of our industry. We would be very happy to see the Europe Union allow insect derived protein to be used in poultry and pig farming. Or have better access to materials to feed insects such as 'former foodstuff'. At the same time, insect producers are limited to what they are allowed to feed their insects based on EU legislation. Within the legislation insects have the same status as other livestock animals and therefore the same rules apply. As a result, we cannot feed our insects any other feed material which you could also feed to a pig or a chicken.

I believe there is a great opportunity to use insects as a vehicle to transform many different potential feedstocks such as pre-consumer waste and catering waste into more valuable and safe proteins and fats. In order to have these feedstocks for insects allowed in the European Union we will need to prove this safe and results in clean end-products. I am confident we will get there.



Jane: And, are there any other controversies around insect feed? What other arguments have you heard against the use of insects as food for animals?

Jonathan: Not really, there are no big arguments against the use of insects as a feed for animals. But, the biggest concern would be the use of feed materials to feed insects which cannot be directly consumed by fish, chicken or pigs in order to keep the sustainability aspect relevant when using insects. We will need to place additional effort into proving that it is safe to use products like catering waste to feed insects and subsequently feed insects to poultry or fish. Through this process we are mimicking nature as close as possible and offer a sustainable solution for the long term.

Jane: Then is there any research that's going into insect feed to maybe help alleviate these problems?

Jonathan: Yeah, definitely, the number of articles published in academic literature is growing almost exponentially. Currently research is being conducted in three main areas:
1. Biology and environmental factors impacting the insect in production.
2. New technologies to create more efficient and effective production systems, and
3. Application of insect-derived products in different markets and industries.

Jane: That's good to know! Hopefully with this research, the process of insect feed production can improve in no time [*laughs*]. Anyway, thanks again Jonathan for doing this. I really think this concept is creative and helpful in terms of making our agricultural system more sustainable.

Jonathan: Not a problem at all. I was happy to do this!

For the full article, see foodunfolded.co/insectfeed.

MARIE LÖDIGE

Did GMOs save papayas in Hawaii?

I'm not the biggest fan of papayas. But I know some people love it. Would you believe me if I told you that GMOs have saved papayas in Hawaii from going instinct? Of course, there's controversy around GMOs, but its technology was intended to help crop production. Read on to learn about how GMO tech saved one of the world's favourite fruits.

WHAT WAS KILLING PAPAYA PLANTS?

Papayas in Hawaii had been suffering from PRSV, the Papaya Ringspot Virus. The virus can be identified by the spots on the papaya skin that look like rings (hence its name). It is an aggressive virus that has been killing papaya plants since the late '30s.

It was first discovered as a mild form of infection, that was more annoying than harmful. Over the years it became more aggressive—so aggressive that some Hawaiian farmers even relocated their farms to a different region (Puna) in Hawaii. But, they weren't able to hide for long.

The virus found its way to the papayas once again and at one point in time, it killed nearly all papaya trees, and nearly all the industry and economy reliant on papayas.

HOW DID GMO SAVE PAPAYAS?

This is when GMOs came into play. Scientists had an idea to work on a genetically modified papaya, so that it could withstand the PRS virus and hopefully save the industry and thousands of jobs. A dying papaya industry would mean a lot of Hawaiian farmers losing their jobs because their livelihood is dependent on the papaya industry.

The scientists found the gene that could make papayas resistant to PRSV. They then inbred plants to achieve homozygosity for this particular gene. Homozygosity can sound intimidating, but it's a simple explanation: it means the two sets of genes you inherit are the same. The gene in question creates a coating protein, which helped protect papaya on a cellular level, making them resistant to PRSV.

The next step was the field trial. Non-genetically altered papayas and the new papayas were planted. Within a year, the non-GM papayas were infected with the virus, but the GM papayas were virus-free!

After the successful trial, the papayas were permitted to enter the market by multiple health and environmental agencies (FDA, EPA, APHIS) and made available for farmers. However, even if the GM papaya has saved the industry and its farmers, there were still critics of the use of GM on crop production.

CLASHING PUBLIC PERSPECTIVES

Again, with GMOs in general, worries about the environment and our health are the main points of concern. Specifically, in Hawaii, the concerns ranged from possible contamination of other seeds to possible health risks for those who eat GM papaya.

In 2013, a council hearing at the Hawaii county council ended with the ban of GMO papaya in Hawaii. It was met with a lot of backlash, especially from farmers that were left, once again, with no papayas they could plant that would be safe from PRSV. The first group of papayas were killed by a virus, and the second group was perceived to be 'killed' by a policy ban. Others felt that the scientific consensus was ignored.

Those who wanted to save papaya production from PRSV protested, and in consideration of their voices, the new law only bans new genetically modified crops and exempts the papaya. Nevertheless, GMOs are still heavily protested, and farmers still face backlash today.

Whether you like papayas or not, what do you think of using GM as a way to help crops survive and farmers to keep farming? Or can you think of an alternative solution?

For the full article, see foodunfolded.co/GMpapayas.

LUKE CRIDLAND

Beetle Banks: A Natural Alternative to Pesticides

From the moment we plant our food in the ground to the moment we eat it, there's always something else looking to get a bite too.

"Naturally, farmers want to get rid of these pests as quickly and as easily as possible, because their crops are being ruined and, natural predators can be a great way of ticking both boxes."

Take a free online course exploring more alternatives (see back for details).

Whether fruit, veg or cereal, crops are a tasty morsel for many living things. Insects, for example, can be one of our biggest food foes. One method farmers use to protect their crops is something called beetle banks.

WHAT ARE BEETLE BANKS?

A beetle bank is a strip of land in the middle of a crop field specifically created for insects, not for crops. Beetle banks are intentionally put there to act as a home for aphid-eating insects and spiders. These beetle banks were the brainy idea of UK farmers from the early 1990s. The concept is simple, yet effective.

So why do farmers want predatory insects in the middle of their field? That's valuable land that could be used for crops, right? Well, aphids and a few other insects out there are also eating farmers' crops. Naturally, farmers want to get rid of these pests as quickly and as easily as possible, because their crops are being ruined. And, natural predators can be a great way of ticking both boxes.

HOW BEETLE BANKS WORK

But you may be thinking, why aren't these insects *already* chomping up these aphids and their buddies, if they are indeed their natural predators? Well, many of these predatory insects can't actually *reach* the pests in the middle of crop fields, with their homes being in the more naturally wild terrain surrounding crop fields. That might not seem that far to go for us, but in insect terms, that's like going to another country.

If the food is there though, surely, it'd be worth the trip and staying? Well, crop fields aren't ideal places for these insects to live in either, especially during their hibernation over winter. And that's where beetle banks come in. Here, a strip of land is put aside in the middle of a crop field to plant grass (tussock grass, to be exact). Tussock grass is known for breaking out into big tufts, and they act like insect apartment blocks for these little guys.

So, with insects being able to stay warm and dry in beetle banks over the winter, a bug city is formed. And come summer, these insects pay the rent for their new homes by munching away on all the pesky, crop-eating bugs next door in the crop field.

This is great for farmers, as not only do beetle banks significantly reduce crop damage, they are a control method that does so without a drop of pesticide!

WHERE ARE BEETLE BANKS USED?

So, there you have it, beetle banks are an innovative agricultural technology as they actually use what nature has given them to their advantage, helping in the effort to keep our food just for us (sorry bugs). Their benefits are starting to come to the attention of others too, with the Netherlands introducing beetle banks in 2017 and Belgium doing the same in 2018.

For the full article, see foodunfolded.co/beetlebanks.

JANE ALICE LIU

Pesticide Alternatives Making Use of Nature

Pesticides might improve crop yield and productivity, but they can also deteriorate the environment in the long-term—contaminating ground water, soil and its fertility, and even the air. They can harm other beneficial soil organisms, insects and plants, and can be toxic to animals (like fish and birds).

With such clear environmental and ecological impacts of pesticides, it's no wonder government regulations have hammered down, becoming more strict. Moreover, the potential health effects of pesticide residue have scared more and more of us into buying products we think are pesticide-free. Even if policies are in place to ensure legal maximum residue levels, which have been deemed scientifically safe for consumption, the movement towards avoiding pesticides has been gaining momentum.

"If you plant tomatoes with cabbage, the tomatoes naturally repel diamond-backed moth larvae that eat cabbage. Or, basil with tomato can fend of flies and mosquitoes."

Yet, pests are still a major problem in food production. And, I'm not certain I would want to see a caterpillar in my salad (even if it's a good source of protein).

Here are 3 agricultural alternatives that can keep crops pest-free without conventional pesticides:

1. Biocontrol (aka: biological control)

It's not as scary as it sounds—think of *bio* in terms of biology, and *control* as in maintenance. Essentially, biocontrol is using a pest's natural enemy (like a specific insect or bacterial strain) to fend off the pests. Extensive research is conducted to ensure that these natural enemies don't inflict unintended damage to the native vegetation or other insects, only targeting the specific pests eating away at crops.

But biocontrol is not a modern invention. In fact, it was first reportedly used in ancient China around 304 C.E., in which citrus fruits were protected by ants from other insects! Today, other organisms are also being used, like microscopic worms (aka: nematodes).

2. Polyculture (companion planting)

Think of *poly* in terms of many, and *culture* in terms of growth (like crop growth in agriculture). Essentially, it means planting multiple types of crops in the same field rather than just one specific type. Within polyculture, there is a concept called 'companion planting'. It's just as it sounds: you plant partner-plants together with crops as a means to support the crop.

From a pest-control lens, it's ideal to plant plants that naturally repel specific pests of your crop. For example, if you plant tomatoes with cabbage, the tomatoes naturally repel diamond-backed moth larvae that eat cabbage. Or, basil with tomato can fend of flies and mosquitoes.

3. Natural barriers & predators

You know how feudal lords used to create a moat around their castle to create additional barriers of defence? Natural barriers against pests are somewhat similar, except it's more about planting rather than just digging.

For example, UK farmers plant tussock grass to cut across the middle of their agricultural field, giving a home to beetles and spiders that would protect the nearby crops from aphid pests.

Each of these alternatives have a different scalability in agricultural production. But hopefully you can implement some of these alternatives in your own backyard or urban farm!

For the full article, see foodunfolded.co/pesticidealternatives.

Mealworm Polenta Roulade

By Essento

We've created this recipe to highlight how we can incorporate edible insects into our diet in creative ways. This recipe spices up a traditional polenta by adding mealworms into the mix, serving between 4-6 people. This unique polenta roulade was part of our cookbook "Grillen, Heuschrecken & Co.", in which you can find 50 different recipes and essays from experts about edible insects. You can find the original recipe in German on our website (www.essento.ch).

Essento Team

POLENTA

Polenta	200 g
Vegetable broth	400 ml
Freshly chopped rosemary	1 tsp
Grated parmesan cheese	2 tbsp
2 egg yolks	
Olive oil	

TO MAKE THE POLENTA:

Bring the vegetable stock to boil together with the chopped rosemary.

Stir in the polenta and simmer for about 3 minutes, stirring constantly.

Remove from heat and add the grated parmesan and egg yolks.

Spread the polenta mixture on a heat-resistant transparent foil to form a square.

POLENTA FILLING

Frozen meal worms*	150 g
Pecan nuts	100 g
Sundried tomatoes	50 g
1 egg yolk	
Oregano (chopped)	1 tbsp
Salt	1 tsp

*Or if frozen mealworms are unavailable, use 50-80g freeze-dried mealworms. To prepare, rehydrate freeze-dried mealworms in lukewarm water for about 10 minutes, until they double or triple in weight.

TO MAKE THE FILLING:

Fry the mealworms in a frying pan together with the pecan nuts until dry and then puree to a fine paste together with the remaining ingredients of the filling.

Spread the mixture evenly over the spread-out polenta, leaving a strip approximately 2 cm wide on one side.

Carefully roll up the roulade using the foil and leave to cool in the refrigerator for about 4 hours.

Once the roulade has cooled, remove the cling film and cut the roulade into slices about 1 cm thick. If the polenta mixture sticks to the knife, hold it briefly under cold water.

SOY & PEPPER SAUCE

Red wine	300 ml
Soy sauce	100 ml
Vegetable broth	50 ml
Crushed pink peppercorns	1 tsp
Corn starch	½ tsp

TO MAKE THE SOY & PEPPER SAUCE:

Heat the red wine in a pot until it is reduced by half.

Add the soy sauce, vegetable stock and pink pepper and simmer for about 10 minutes.

Thicken with the corn starch.

SUGAR SNAP PEAS BED

1 shallot	
Butter	1 tbsp
Sugar snap peas	400 g
Fresh salt and pepper	

TO MAKE THE SUGAR SNAP PEAS BED:

Chop the shallot finely and fry in the butter until translucent.

Add the sugar peas, season with salt and pepper and steam until slightly crunchy.

THE FINAL TOUCH:

Fry the polenta slices in a frying pan in a little olive oil at medium heat until golden brown.

Arrange on a bed of sugar peas, sprinkle with the soy-pepper-sauce and serve.

Special Diet Information
Insects have a similar biological structure to crustaceans. Accordingly, people who are allergic to crustaceans can also react allergically to insects. Likewise, people with allergies to house dust mite can be allergic to insects.

How Insects Help Reduce Food Waste

JANE ALICE LIU AND MIHA PIPAN

Insects aren't just six-legged pests! There are many ways in which insects help our environment and agriculture. Here's how insects help reduce food waste.

You might have recently heard that our insect population is plummeting with a 40% decline in species. Maybe this made you realize how important insects are to our planet, from pollination to maintaining the health of soil. But did you know that insects can play an important sustainability role in food and agriculture?

There's been a lot of talk about how edible insects are a great protein alternative, but insects also help recycle agricultural waste. And actually, there are some producers who are now expanding to own insect farms.

We interviewed Miha Pipan to clarify more on the sustainability of edible insects, how insect-farms work, and other insect agricultural benefits. Miha is the co-founder and scientific officer of Entomics, a start-up that's tackling food waste through insect biomass conversion. Here's what he has to say:

Jane (me): Can you tell us a bit about yourself, Miha?

Miha: Where to start—how did I end up in the world of maggots? A lot of serendipity. I was studying at University of Cambridge when I co-founded Entomics with my fellow students. Entomics was created to address the challenge of food waste through insect biomass conversion.

Jane: Wait, pause. What is insect biomass conversion? And how does it help food waste?

Miha: Insect biomass conversion (or insect farming in short) is when insects turn organic wastes (such as used-grains from beer-making, or expired fruit and vegetables from packaging facilities) into highly nutritious outputs, like proteins and other nutrients.

And, we can even mitigate organic waste greenhouse gas emissions by feeding the waste to insects. If food waste emissions were its own country, it would be the third largest emitter after the US and China!

Jane: Oh wow! I have so many questions. But first, what exactly do you do at Entomics?

Miha: Over the past 3 years, together with my cofounders Matt and Fotis and a growing team, we've been working towards developing new technologies that will help bring insects to the forefront of sustainable future food & feed.

"The vast majority of our food production depends on insect pollination. Not to mention their role in biomass recycling and soil health."

I'm personally in charge of our scientific vision & research. I spend a lot of time working with insects, especially black soldier fly maggots.

Jane: What role do insects currently have in food production?

Miha: When we talk about the role of insects in food, they're absolutely essential. The vast majority of our food production depends on insect pollination. Not to mention their role in biomass recycling and soil health.

It's especially disheartening seeing the recent reports on world-wide insect population declines, when one knows how essential these critters are to our global food production.

But insect biomass conversion can empower communities across the globe to convert local organic wastes into useful resources, to be fed back into the food production system. The technology of insect farming is simple and requires low inputs, so this is something that can be applied in low-resource and high-resource countries alike, which means a lot in terms of its true global impact.

Jane: So, what can you tell us about insects as food?

Miha: Well, they are rather wonderful from the scientific perspective. They are incredibly efficient at converting what they eat into their own biomass–which makes them excellent food & other wastes recyclers.

They manage to achieve this conversion very quickly, particularly the black soldier fly larvae. A couple grams of black soldier fly eggs will yield kilos of maggots in as little as two weeks. That's stunning! There is a real potential here to convert the millions of agricultural waste tonnes produced globally each year, into tonnes of highly nutritious foods & feeds.

Jane: Of course, there's a stigma against eating insects in some cultures. Why do you think this is? Do you think we can ever overcome that stigma?

Miha: Stigma is they key reason why Entomics (and many other producers and tech developers in this sector) is focusing on animal feed, as opposed to human food. It's still possible to change stigma, but currently, the industry still requires focus on improvements in technological and scalability.

Having said that, I think stigma can be overcome. Look at sushi in Western countries, for example. Raw fish was a no-no back in the day, whereas now, people pay fortunes to have 'good sushi'. The bottom line here is that sushi can be delicious. So, once a person tries it and ends up liking it, the raw fish stigma evaporates.

I think the same approach should and can be taken with insects in Western countries. First, it is up to us (the industry) to develop tasty insect products that can be used in every kitchen, irrespective of the sustainability fervour. The best way to do this is to create a genuinely tasty and healthy product (but flavour-wise...there's still way to go to develop truly delicious insect foods!).

Jane: Which insects have your tried? And, which one did you think tasted the best?

Miha: I try as many as I can (haha). Crickets are my favourite (shrimp of the land, anyone?)—although, they are also the most resource demanding when it comes to insect-farming. Mealworms taste pretty good too. As for black soldier fly larvae...the really high fat content makes them a bit of an 'acquired taste' at the moment, but I've had exceptionally 'tastes like chicken' experiences with them too.

Natural flavour-wise, crickets & locusts offer the broadest spectrum of taste. It's quite easy to marinate them 'from the inside out' by feeding them herbs a couple of days prior to cooking. It's not too different from the concepts used in cooking with escargot (land snails). But as with most things, the vast majority of off-the-shelf insect foods are roasted, so they really do end up tasting rather umami—most people would say they taste like chicken.

Jane: Are there any insects you don't like?

Miha: They key thing when eating insects from my experience is to be ready for the chitin, which is the insect shell. It's quite 'paper-y', and not very 'Western palate 2019'. Hence, most insect products currently sold on European shelves are very finely milled powders or dechitinated products.

But the way an insect tastes can also be changed. This is where food processing tech, like Entomics' insect fermentation technology, can open up opportunities for developing innate insect aroma and flavour into something that is much more palatable (perhaps even delicious) to people who normally wouldn't ever consider eating insects.

Jane: But, aren't insects dirty? How do they even 'wash' the insects? Don't they carry diseases?

"Insects have an immense potential in helping humanity deal with the facing threat of climate change and food production resilience."

Miha: I wouldn't say insects are any dirtier than the livestock animals we currently farm. Most of the insect products for food or feed available today are processed–washed, pasteurised or even sterilised, before being dried. All these steps eliminate the risks of disease.

What is more, all insect products available 'off-the-shelf' already undergo strict health and safety checks and passes, and have to comply with current standards, so there is no reason to worry about insect products being any dirtier than other products you find in store now.

Jane: How do insect farmers make sure their insects are safe to eat?

Miha: Farmers feed insects cleaner wastes than those they theoretically are able to grow on. This is a good strategy to reduce the inherent microbiological & chemical risks. In Europe, insect farmers can currently only grow insects using 'low risk' stocks (not too far from those used in farming other animals).

If anything, due to insects being so new on the scene, producers have to go the extra mile to show their products are safe for consumption. The quality control in this sector is perhaps even higher than a lot of traditional food products which can simply rely on their long track records of human usage.

Much work remains to be done here, and of course as the sector grows, so will our knowledge around this topic.

Jane: Do we already consume insects as an ingredient in some of our food products? I know some food producers in America use red cochineal beetles as red dye, but are insect-based ingredients common?

Miha: Large scale insect farming (particularly in the West) is so new that any widespread adoption of insect ingredients is not quite there yet. Of course, we can consume insects in, say, salads (by accident hopefully), but I'd say our accidental consumption of insects is rather low.

Jane: What are the different forms of food you can find insects in? I know there are whole crickets you can eat, or cricket flour, but what other products can they be made into?

Miha: Flour-like products made with insects seem to be the key thing on the market as of now. This makes sense, since flour can be easily integrated into staple foods, such as breads, crackers, pasta, tortillas, any bakes & cakes.

Insect protein extracts are also popular, often used in protein shakes and bars for the sustainability-minded gym-goers. Furthermore, finely milling insects removes the unpleasant mouth feel of chitin (which I personally think is rather important).

But of course, one can also buy whole insects (dried or canned), frozen or even fresh (subject to being close to suppliers).

Jane: Which insects have the highest amount of protein?

Miha: This is an interesting question. For starters, there is a trend in insect products to (perhaps accidentally) over-estimate the amount of crude protein. The reason for this is that insect shells (chitin) interfere with standard protein measurement methods and tend to boost the protein content by up to 25%, depending on the species.

Having said that, when it comes to mainstream farmed-insects, it would appear crickets and locusts boast the highest protein content. I have seen products with as much as 70% crude protein in a dry powder form.

But it is also possible to turn lower protein content insects (such as black soldier fly larvae) into high protein content concentrates & isolates with the right processing steps. This is something we've been perfecting at Entomics.

Jane: What other nutritional qualities do edible insects provide?

Miha: These creatures are rich in essential amino acids, which can be scarce in plant-based foods. We also found them being rich in minerals like iron, often beyond what one would find in mainstream meats.

Even the less desirable elements of an insect (such as their shells which are made from chitin) have functional applications in human and animal nutrition. Apparently, chitin and its derivatives have fat binding properties.

Jane: There's a lot of talk about how edible insects can be a sustainable alternative protein, but what other aspects of sustainability can insects help?

Miha: Insects have an immense potential in helping humanity deal with the facing threat of climate change and food production resilience. From the inherently low usage of land, to the ability of insects eating decomposing wastes (which is a major cause of methane emissions worldwide), to the marginal lower water usage per kilo of protein produced. I could go on for a while on this topic...

We could even start using insects to convert other types of wastes–for example, plastic wastes. There was a couple of research articles showcasing the ability of waxworms to eat plastic bags (which are otherwise poorly recyclable and would naturally take eons to self-degrade). Then there is animal manures and sewage–of course again, this would not be for food production purposes, but with growing cities and concentrated populations, insects may help clear the waste and maintain a cleaner environment and water supply.

Jane: That's really cool! It sounds like we're going to have to have another interview on insects and plastic waste! But to wrap up, is there anything else you'd like to add?

Miha: We may even end up using insects as living factories for production of medicines! We know many insect species can naturally produce antimicrobial compounds. Given increasing issues of antimicrobial resistance, these insects are likely to gain in importance going forward.

As the insect biomass conversion technology matures and evolves, who knows what the future may hold – we are only really farming teeny tiny fraction of insect species at any meaningful scale as of now (black soldier fly, mealworms, crickets, buffalo worm, silkworm), where insect diversity it truly stupendous (like 80% of all known living organisms described to date are insects!).

This is certainly a space to watch.

For the full article, see foodunfolded.co/insectfarming.

Custos

Latin meaning '**guardian**' or '**protector**'.

From its soil, we grow food to eat.
From its minerals, we build tools to keep.
From its water, we drink.

The planet has provided us with its resources for centuries. There's only one Earth, so how do we find harmony in coexistence? See our final chapter to discover links between food and sustainability.

KATHARINA KROPSHOFER

Plant-Based Milk Alternatives Environmental Footprints

Many of us already choose plant-based alternatives to dairy products, others might be wondering which option to buy. But how can you know, which one is best for you and the environment?

Just when we think we might have figured it out, the solution often turns out to be a bit trickier than expected: with vegan, plant-based milks, one might–literally–trust their gut and go for the best-tasting alternative (I'm team oat milk!). Yet, if the reason for your choice of plant-based alternatives is driven by environmental concerns, the sustainability differences between the available options is significant.

Joseph Poore is an environmental scientist at the University of Oxford. Together with his colleague Thomas Nemecek, an agricultural scientist at Swiss Institute Agroscope, he produced one of the biggest studies comparing environmental impact of agricultural products. To do that, they compiled data from 3,000 studies for about 40 different products.

SUSTAINABLE DIETS

Even though some of the studies' messages are surprising and complex, one message comes across very clearly: eating less or no animal products is the single biggest way to avoid impact on the environment.

You've likely heard this before, but why? The problem lies not only between high CO_2 emissions, vast water consumption and flatulent cows (meaning, more atmospheric methane), but also in its poor land use. Livestock only provides 18% of the calories we need, yet it takes up 83% of our worldwide farmland. Additionally, all animal products–even if they are produced with the smallest environmental impact–lead to higher levels of CO_2 emissions than plant-based products.

BUT WHICH PLANT-BASED ALTERNATIVES ARE MORE SUSTAINABLE?

If you think that all milk alternatives are equally sustainable, I might have to disappoint you. Joseph Poore took a closer look and compared four plant-based milk alternatives, and we added extra information on another crowd favourite: coconut 'milk'. Below is a quick summary of the environmental pros and cons of the five most common milk alternatives.

It is not easy to make a choice and there does not seem to be a satisfying answer to the question of "what is the right milk alternative". But here is a suggestion: why not mix it up a bit? In the end, moderate consumption has often proved to be a smart solution.

For the full article, see foodunfolded.co/plantmilk.

Coconut

Coconut trees grow in tropical areas like Thailand, Sri Lanka or the Pacific with plenty of water available. Yet, just like palm oil trees, they are often grown in deforested areas, leaving a high impact on tropical biodiversity. On a good note: ecosystems based on coconut trees enhance carbon sequestration in agro-ecosystems.

Soy

For many, soy 'milk' is the first stop when looking for milk alternatives. In contrast to almond 'milk', it has other strengths and pitfalls: we can see the best results in terms of water usage, and its land use is also comparatively lower in impact. When it comes to greenhouse gas emissions, however, it falls behind oat and almond 'milk' with about 0.7kg of CO_2 equivalents emitted for every liter. And here is something else to factor in: international soy farming has a devastating impact on the rainforest, especially in the Amazon. Since soybeans also grow well in many European countries, a look at the label of origin can be useful.

Oat

Which leads us to the last alternative the two scientist made calculations for: oat 'milk'. We can see quite a small impact in terms of land and water use. In terms of greenhouse gas emissions, it ranks behind almond 'milk' with less than 0.8kg of CO_2 equivalents emitted per 1L. Good news also comes from the way oats are grown. In an interview with *The Guardian*, Michaelis Hadjikakou, a researcher from Deakin University (Melbourne, Australia), says that it is often grown as a winter cereal and mainly fed from rainwater rather than irrigation.

Rice

Poore and Nemecek also calculated the effects of rice 'milk', a further tasty alternative. It ranks best in land use with less than 0.3 m² needed to produce 1L. But it is just doing a little bit better than almond 'milk' when it comes to water use and produces the most greenhouse gas emissions out of the four plant-based milk alternatives. Rice farming is estimated to account for 2.5% of current anthropogenic warming due to emissions of methane. Massive amounts of nitrous oxide (N_2O), another long-lived greenhouse gas, is also emitted during the flooding process of the rice fields. Studies show though, that climate impacts of rice cultivation could be reduced by 90% if we manage to select the most climate-friendly water management regimes.

Almond

Looking at almond 'milk', the factor of water plays a big role. With 371L of water needed to produce 1L of almond 'milk', this milk alternative ranks far behind rice, soy or oat 'milk'. Since its almonds are often grown in arid areas like California, which are already suffering from water scarcity, almond production can lead to environmental problems. But when we take a look at greenhouse gas emissions and land use, almond 'milk' actually ranks better than its plant cousins.

Dairy milk

Let's take a look at cow milk. In comparison, the environmental effects of one liter ranks worse than any plant-based alternative, no matter which aspect you choose to look at. Three times as many greenhouse gases are emitted compared to the production of soy, rice, oat or almond milk alternatives. Looking at land use, cow milk is doing eight times worse. And when it comes to the usage of water, results seem even more dramatic: 120L of water are needed to produce 1L of milk.

Source: Poore & Nemecek (2018) Science. Additional calculations from J. Poore

JANE ALICE LIU

Fuel Made from Food Waste

Did you know you can convert food waste into fuel? In Sweden, biogas has been generated from food waste to power households, local buses and even trains as part of their recycling revolution.

HOW DOES SWEDEN DO IT?

The Swedish have transformed over 2.3 million tonnes of household waste into energy.

Swedish residents first separate their food waste from other waste (like plastic), which is collected alongside waste from canteens and restaurants. This waste is then blended into a slurry and stored in tanks that are taken to local biogas plants, where it is preprocessed and undergoes anaerobic digestion. After the food waste has been broken down, it leaves 1) bio-fertiliser, which are used as fertiliser, and releases 2) methane, which is captured and compressed into the biogas that helps power Swedish public transport.

Food waste can also be taken to local waste-to-energy (WTE) plants, piled and sorted, then burned at 1000°C. This heat produced at these plants then warms up water for the radiators in Swedish homes. Sweden now even imports garbage from neighboring countries as part of their waste-to-energy (WTE) initiative.

In biogas plants, fuel is produced through a natural process as recycled waste is broken down by microorganisms, producing the gas methane. The process is only effective in high-pressure environments with little to no oxygen.

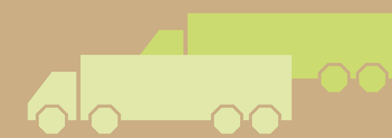
The energy produced from food waste has helped power over 250,000 Swedish homes and roughly 20% of district heating. In the coming years, Sweden will continuously improve its resource efficiency.

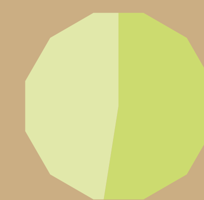
Could you imagine a world without food waste rotting in landfills? A world where waste can power our energy use? How awesome would that be?

Sweden's Recycling Revolution: Food Waste

88 million tonnes of food waste

That's equivalent to 3.4 million freight trucks which means 9.2k more trucks in daily traffic jams





52.8% could be avoided.

That's equivalent to 3.4 million freight trucks which means 9.2k more trucks in daily traffic jams

Most wasted foods:

Vegetables, fruit, dairy, cereal

Food waste costs the EU €98 billion per year

There are two different plants where waste can be turned into energy:

Trivia

1. WHAT IS THE TRADITIONAL WAY OF CREATING A WASABI PASTE?
a. Oroshigane (shark skin grater)
b. Ginger grater
c. ganeun salam
d. Rifjárn

2. WHICH OF THE FOLLOWING FOODS DOES NOT CONTAIN MANY PROBIOTICS?
a. Yoghurt
b. Sauerkraut
c. Sausage
d. Natto

3. WHICH EUROPEAN COUNTRIES ARE KNOWN FOR CHEESE MADE FROM UNPASTEURISED MILK?
a. France and Belgium
b. France and Denmark
c. Poland and Italy
d. Germany and the Netherlands

4. WHAT ACIDS DO CHICKPEAS PRODUCE TO PROTECT THEMSELVES FROM PESTS?
a. Salicylic acid
b. Malic and Oxalic acids
c. Formic acid
d. Uric and Citric acid

5. WHAT IS THE IDEAL WATER CONTENT FOR HONEY TO RECEIVE THE SEAL 'REAL GERMAN HONEY'?
a. 23%
b. 15-18%
c. 10%
d. 3-6%

6. MOST OF THE COFFEE DRUNK ACROSS THE WORLD IS MADE FROM ARABICA BEANS?
a. True
b. False

7. KOMBUCHA, A FERMENTED TEA DRINK THAT CONTAINS ALCOHOL.
a. True
b. False

8. WHICH ANIMALS' MILK IS SAID TO BE A PROMISING AND ENVIRONMENTAL-FRIENDLY ALTERNATIVE TO COW MILK?
a. Horse
b. Camel

9. WHEN DID WE HUMANS START USING IRRIGATION SYSTEMS?
a. 1903
b. 14th century
c. 6000 B.C.E
d. 300 C.E.

10. WHAT IS THE STRIP OF 'WILD' LAND CALLED THAT YOU CAN FIND IN A FEW FIELDS TO FIGHT APHIDS?
a. Wild flower strip
b. Beetle bank
c. Ladybug housing
d. Insect street

ANSWERS PAGE 98

JANE ALICE LIU

6 Things to Know About Compostable Plastic

Compostable plastic utensils seem to be popping up everywhere these days. But what I didn't know was that these compostable bioplastics are only able to be broken down in an industrial composting facility. Meaning, I can't just throw it in any compost bin (a bit misleading, I know).

Here are 6 key things you should know about compostable plastic utensils and straws:

1. COMPOSTABLE BIOPLASTIC UTENSILS AND STRAWS ARE MADE OF PLANT-BASED PLASTIC.
Plastic has traditionally been made out of petrochemicals (aka: oil). But, compostable plastics are made of polylactic acid (PLA) material, which is usually derived from plants like corn and sugar beets.

2. YOU CAN'T COMPOST COMPOSTABLE PLASTIC IN YOUR BACKYARD.
If you thought you could throw away your compostable fork or straw in your personal compost, think again. Yes, it might be labelled compostable. But, it has an invisible word in the label: "industrially compostable".

3. COMPOSTABLE PLASTIC CAN ONLY BE BROKEN DOWN BY MICROORGANISMS IN A HIGH HEAT ENVIRONMENT (OVER 50°C).
They are designed to be composted in industrial-grade or commercial composting facilities, where high temperatures can be consistently reached to break down the bioplastic. Traditional home compost piles never reach such high temperatures consistently.

And, because it's been legally labelled as compostable plastic, it must leave absolutely no toxic residue, so a centralized composting facility can ensure this requirement.

4. COMPOSTABLE DOES NOT EQUAL BIODEGRADABLE.
PLA breaks down into CO_2 and water within 3 months—if done so in an industrial composting facility. Compostable plastics (under EU standard EN 13432) are only labelled as compostable under specific conditions like temperature, humidity level and time. Compostable plastics should never produce any toxic material that affect water, plants, soil or other living beings.

Unlike compostable plastic, there's no set timeframe and no legal requirement regarding toxic residue for biodegradable plastics. So, it can take years (possibly even hundreds of years) to fully break down. And like traditional plastics, they could potentially leak toxic chem-icals into the surrounding ecosystem.

5. DON'T THROW YOUR COMPOSTABLE PLASTIC IN THE TRASH BIN!
Because these utensils and straws require very specific conditions to compost, don't just throw it in the trash bin! It just gets sent to the landfill (where it just sits and doesn't actually get composted). Though, unlike traditional plastics, compostable plastics won't leach toxic chemicals into the environment.

6. DON'T THROW YOUR COMPOSTABLE PLASTIC IN PLASTIC RECYCLING!
Compostable plastics have a great recycling turnover, as the material can be reused multiple times without lowering the quality of the material. But, if you throw compostable plastics in the plastic recycling, you can actually ruin the entire recycling process.

Compostable plastics are made of a different composition compared to traditional plastics. This can lead to more problems when trying to reuse the plastic material into something useful.

Instead, throw them in a specific bin for biowaste. It's then collected separately and taken to an industrial composting facility. Talk to your local officials to see if this option is available near you.

Compostable plastic is a great first initiative to lower the impact of plastic on the environment, especially as it can prevent toxic contamination. But, there are still some other effects and infrastructural changes to make. Don't forget that there's always other compostable material that you can actually throw in your backyard (like wax-coated paper straws). You can always use edible utensils, or even bring your own utensils (made out of metal or bamboo) to use.

For the full article, see foodunfolded.co/compostableplastic.

KELLY OAKES

Do you know the water footprint of these common foods?

It doesn't take too much thinking to realise that both crops and animals being raised for food need water to survive long enough to make it to your plate—but do you know how much?

WHAT IS WATER FOOTPRINT?

Calculating the 'water footprint' of food is a way of measuring how much water was used to produce it.

If you've ever tended to a garden, or even just a houseplant, you'll know that plants need water. The crops that we grow to eat are no different. Though different varieties need differing amounts, all need water to survive and make it to our plates (and stomachs).

The animals we raise for food drink water too–though most of a steak's water footprint, for example, comes from the plants grown to feed cattle, rather than water being gulped down by the cows themselves.

Water is also used in the processing of food after it's grown. It can take 2kg of water to rinse a single kilogram of lettuce, for example.

BEEF IS THE MOST WATER INTENSIVE FOOD

The food that needs the most water to produce is bovine meat, such as beef, at over 15,400 litres of water per kilogram. Other meats, like lamb, goat, pork and pig meat use between 6000-9000 litres of water per kilogram. Chicken ranks the lowest compared to other types of meat, at just 4500 litres of water per kilogram meat.

The water footprint of meat in general is higher than plant crops, because of all the plants that need to be grown in order to feed these animals.

DAIRY HAS A HIGH WATER FOOTPRINT

Because dairy is an animal product, it also has a high water footprint. It takes more water to produce a kilogram of butter (at around 5500 litres) than it does to make a kilogram of chicken, for example.

Milk fares a bit better: it takes around 1000 litres of water to produce a kilogram. Making cheese uses a lot of milk, so its footprint is higher at around 4000 litres per kilogram.

PLANT-BASED FOODS ARE NOT OFF THE HOOK

Pulses and nuts also need lots of water in order to make it to the dinner table. On average nuts have a water footprint of around 9000 litres per kilogram. Pulses come in at around 4000 litres.

For those in need of good news, you should know that vegetables are the shining stars of water consumption, averaging just 300 litres of water per kilogram. Fruits come in a little higher at 900 litres.

MAKING FAIR COMPARISONS

It's worth thinking about how much of each foodstuff we tend to use when comparing water footprints. For example, a kilogram of milk is roughly equal to a litre–an amount some people could easily drink over a couple of days. A kilogram of butter would, however, take a lot longer for most people to eat. Even though butter's water footprint is higher by weight, your personal water footprint could be affected much more by gulping down milk compared to using a little butter on your toast.

Another way is to compare foods based on the amount of water used per gram of a specific nutrient. Butter actually has just half the water footprint than most oil crops when you look at it this way, at 6 litres of water per gram of fat, versus 11 litres for oil. And per gram of protein, beef has a water footprint six times larger than that of pulses.

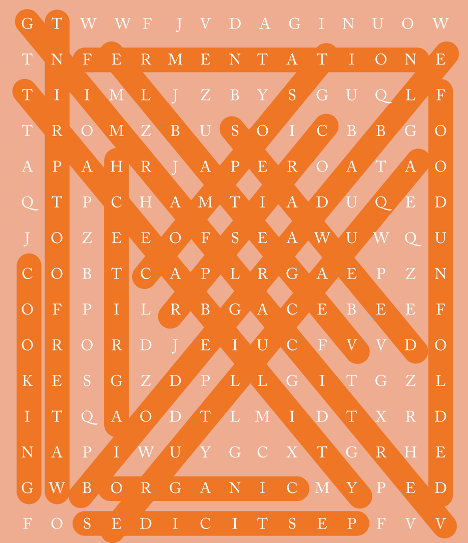
FINDING WAYS TO USE LESS WATER

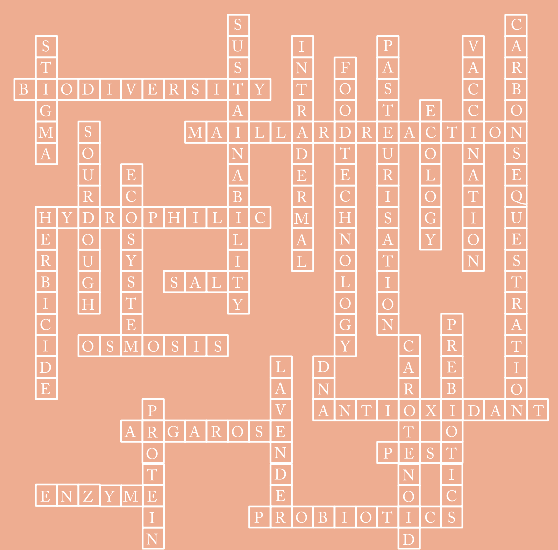
The amount of freshwater available on Earth is limited at 2.5%. Global water scarcity and a growing world population with more mouths to feed than ever, means we urgently need to find ways to use less water.

Some researchers are using bioengineering to create crops, like new varieties of rice, that need less water in the first place. Another innovation uses satellite images to monitor water loss from agricultural land, to help farms figure out how much water their crops need to stop wasteful overwatering. And researchers are also coming up with new ways to clean water after it's been used to rinse produce, so it can be recycled.

For the full article, see foodunfolded.co/waterfootprint.

ANSWERS





1. a. Oroshigane (This is a traditional shark skin grater that creates the perfect wasabi paste)
2. c. Sausage
3. a. France and Belgium (In France cheese made from raw-milk makes up roughly 10% of the market and the Belgians are strongly defending their historically-charged Herve cheese)
4. b. Malic and Oxalic acids (Malic acid is what gives apples a sour, tart like taste and oxalic acid tastes sour and can be lethal in large doses)
5. b. 15-18% (15-18% gives the perfect honey. To little can make the honey crystalize and too much can lead to yeast and bacteria developing.)
6. a. True
7. a. True (Kombucha contains alcohol created during the fermentation process – but in commercial brands this is usually less than 0.5%, so it's nothing to worry about for most people.)
8. b. Camel (Camels are not ruminant animals like cows, which means they produce less methane. At the same time, camel milk has high nutritional value.)
9. c. 6000 B.C.E
10. b. Beetle bank (These banks are in the fields because the way to the inside of the field is too long for beetles from the sides but doable form the bank)

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