

Finding the pulse of the protein food boom

How the humble pulse is helping humanity tackle the climate, food and health crises

by James Cooper, MAG Contributor

As a child of the 1970s I can remember the day my mum discovered tinned chickpeas on the supermarket shelf, then secreted them into our food. Casually tossed into a curry towards the end of cooking, these yellow blobs hid in plain sight amongst similarly shaped chunks of chicken.

It was a lucky dip, hoping to get the chicken, but the disappointment of getting the whole chickpea was palpable. They'd end up neatly arranged around the edge of the plate. A dry, floury blandness accompanied by an unwieldy dense mouth-feel put me off this unassuming and nutritious ingredient for probably 20 years. Then a friend introduced me to his national cuisine, a real Israeli felafl, made with the very same humble pea.

For me, it was nothing short of an epiphany and a lesson that these are simple wholefoods that require some preparation, careful seasoning and maybe a bit of love to unlock their inner deliciousness.

Of course, consumption of pulses is nothing new: They have a rich and colorful history of nourishing cultures all over the world. It's estimated that humans have been growing and eating pulses for more than 11,000 years. In medieval times, dried beans and peas were a staple food and the main source of protein for most of the UK population, but as meat and dairy products became more widely available pulses fell out of favour in the UK almost completely. All credit to my mum then, with her great instinct for nutrition. She was an early adopter of pulses in her cooking at a time when they had previously been stigmatised as hippy food, or food for the poor.

But in recent decades there has been a steady renaissance of pulses. The UK tastebud seems to have developed a certain cultural maturity. Hummus for example, made from chickpeas, unheard of in the 1980s and 1990s, is now ubiquitous and can be found on the shelf of even the smallest UK supermarket. A

collective environmental conscience, the recent shift towards so-called "clean label" eating and "meat-free" has meant that pulses, lentils, peas and beans are all undergoing a revival and not just in the UK.

It's easy to see why: These are the most sustainable plant protein source and they're super healthy for you. Not only do they reduce your risk of diabetes, cholesterol, heart disease, obesity, even certain cancers, but for the farmer pulses make perfect sense too. They are drought tolerant, require less irrigation than wheat, corn and soy crops. Plus, pulses supply their own nitrogen, leaving it in the soil for the next crop, saving on the cost of fertiliser and improving soil condition in one hit.

"They are one of the only crops that can do that," explains James Maguire from UK Pulses, the UK's only independent trade body. Pulses can be easily rotated around traditional crops and prevent soil degradation associated with excessive deep tilling and mono-culture farming.

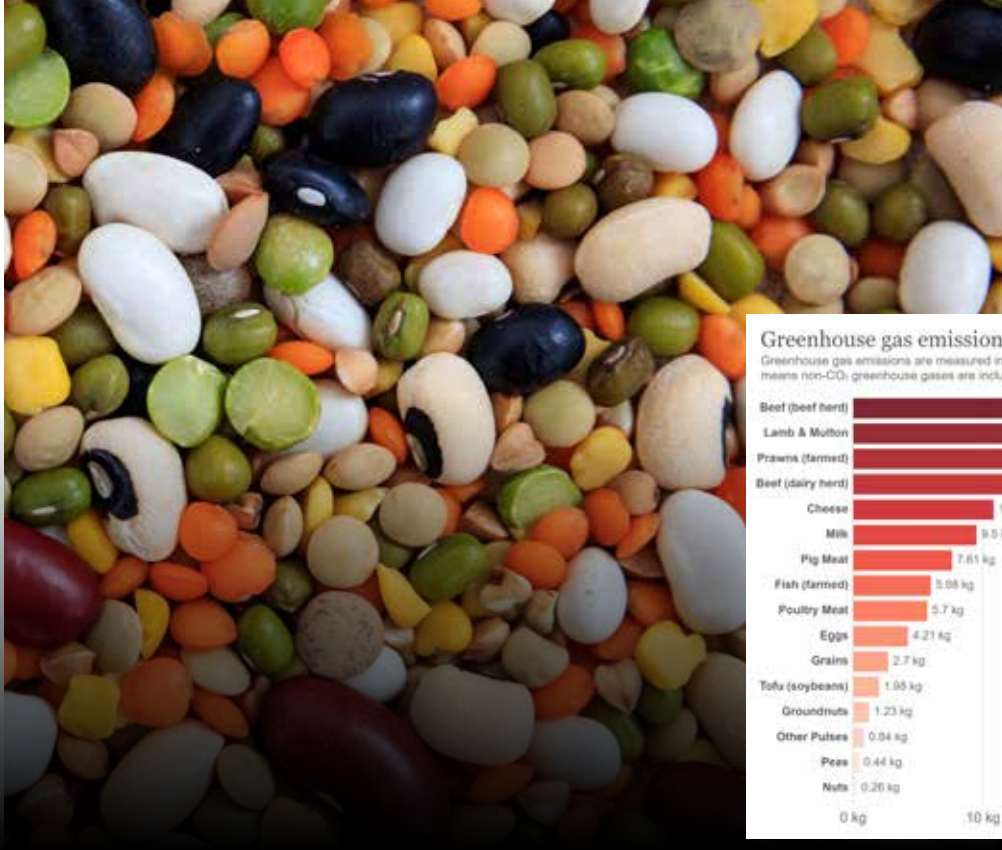
The growing global demand for plant protein is also a good opportunity to shift away from mainstream protein crops, such as soybean which is losing popularity due to environmental and allergenic concerns. According to industry sources, pea protein is now poised to replace soy protein in five to 10 years.

The #sustainable push

Google anything to do with sustainability and meat production and expect to be presented with a bewildering array of statistics proving how intensive meat farming is breaking the planet. Consequently, there's a big consumer push against the environmental cost of meat production, despite the relative affordability and popularity of meat on the supermarket shelf.

The message from the meat industry maintains that eating meat is healthy, we have after all evolved eating meat, but consumer focus is moving towards eating much less: enter the clever vegetarian or 'flexitarian', where no hypocrisy is implied.

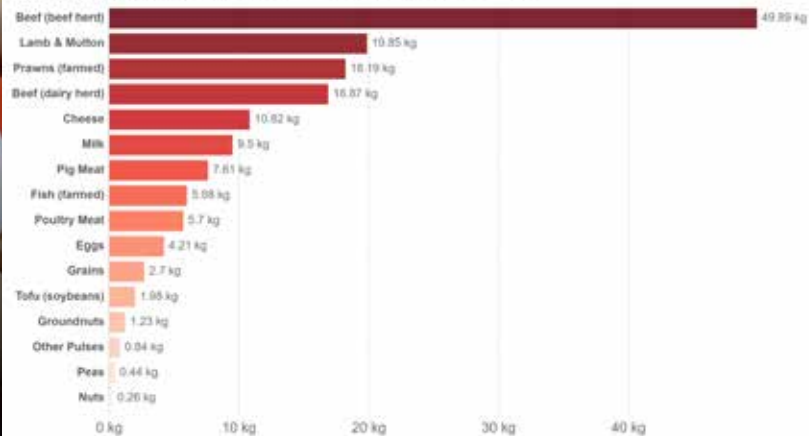
The new argument is no longer about whether meat is healthy or ethical: it's about the sustainability of the entire industry. We know that meat comes with a high carbon price tag and is



Greenhouse gas emissions per 100 grams of protein

Greenhouse gas emissions are measured in kilograms of carbon dioxide equivalents (kgCO₂e) per 100 grams of protein. This means non-CO₂ greenhouse gases are included and weighted by their relative warming impact.

Our World
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responsible for significant deforestation, directly and via animal feed crops. But it's also vastly inefficient in terms of water, energy and land that could be better used to grow food crops for direct human consumption. Few would argue meat production is sustainable in terms of meeting the food demand for the expected population of nine or 10 billion in 30 years time.

So, has meat had its day?

For the consumer, how to eat sustainably is still very confusing. Sustainable means different things to different people. I may consume only 'free-range meat', another may say 'eat only grass-fed' meat, others say 'all meat is bad'. And it can be difficult, if not impossible, to get carnivores and flexitarians to even try plant-based proteins if they don't remotely taste, look or function like the real thing. Especially when real meat is cheaper.

This is where food production technology seems to be changing the game. The anti-meat rhetoric has also changed. Gone are emotive campaigns such as the vegan society's 'Meat is murder'.

Instead, we are presented with clever plant-based alternatives that make sense, fresh innovative products that mimic the look and feel of meat, require refrigeration, and have a limited shelf-life.

The market potential is huge. UK sales of meat-free foods are set to exceed UK£1.1 billion by 2024, according to market research published by Mintel in 2020. The numbers show that the sector has seen major growth in recent years, with sales increasing by 40 percent between 2014 and 2019, with producers like Meatless Farm leading the way.

This UK based brand, which claims that its meat-free or fake burgers, mince and sausages (made from pea protein) taste and look like the real thing, is seeking to build on huge growth in the UK as shoppers' interest in plant-based alternatives rose during the pandemic year. Tesco, the UK's largest supermarket, has also become the first UK retailer to set

a sales target for plant-based alternatives to meat as it steps up efforts to offer shoppers more ‘sustainable’ options. Tesco recently committed to boosting sales of meat alternatives by 300 percent by 2025. Over the past year, demand for chilled meat-free foods – the most popular line including burger, sausage and mince substitutes – has increased by almost 50 percent, the retailer said in a recent report published by the Guardian newspaper.

The rise of plant power

Plant-based food is one of the biggest trends in the health food segment and it’s here to stay, because it’s not only the vegan and vegetarian population who make it a major trend. The West is eating less meat, and developing countries are eating more plant-based protein.

An increase in global income levels is also driving demand in developing countries where meat consumption is low. The average European, for example, eats around four times as much meat as someone in Africa. As a result, these countries are seeking to expand diets with more protein.

“As incomes rise, consumer preference moves from wheat and grains to legumes, and then to meat, including chicken, pork and beef,” says David Widmar, agricultural economist at Purdue University, USA.

“If we’re serious about feeding the world’s growing population healthy food, and not ruining the planet, we need to get used to a new style of eating. This includes cutting our Western meat and sugar intakes by around 50 percent, and doubling the amount of nuts, fruits, vegetables and legumes we consume.”

These are the findings of 37 leading experts in nutrition, agriculture, ecology, political sciences and environmental sustainability from 16 countries published in the medical journal *The Lancet*.

The study begins with the observation that, although global food production of calories has kept pace with population growth, there is an uneven and unhealthy distribution of calorie consumption. The result is that health problems such as malnutrition and morbid obesity proliferate in the world and pulses may, in part, hold key to solving these problems.

The market for plant protein

Ongoing advances in milling and processing technology has rendered the question over whether you find pulses delicious largely irrelevant. Arguments over taste no longer matter because peas, specifically yellow peas, are being formulated into such plethora of products, they’re unavoidable, and often invisible. Pick up any protein snack or diet product and you’ll see pea

protein in the ingredients list. Pulses are already playing major role in providing consumers with an alternative protein source, but the potential is underutilised:

“In the UK, the oat milks were originally one of the key things that kicked it off. We’re also seeing pea snacks and pea flours replacing wheat flour, but the big market is going to be products such as ‘Beyond Meat’, synthetic proteins that are predominantly made from yellow peas.” explains James Maguire from UK Pulses.

It’s a market in which the UK has a long way to go, to synchronise viable home-grown crops with consumer products, but one in which opportunity abounds. The UK should perhaps look at the South east Asian example of using locally grown ingredients and short supply chains to innovate these products.

“The biggest problem I have with pulses in the UK is the fava bean,” said James, “No one eats it, no one processes it, no one does anything with it. We actually ship it to North Africa, where it’s a staple foodstuff”.

Despite initiatives such as the British Dal Festival and World Pulses Day (10th February, who knew?), the UK is a net pulse exporter. In a typical year, the country’s pulse output consists of more than 500,000 MT of fava beans and 100,000 MT of peas, including green peas (50 percent of the crop), marrowfat peas (40 percent) and yellow as well as other varieties of peas (10 percent).

The UK pea crop is generally split evenly between the domestic and export markets, exports destined mainly for Asian markets where they are used to make snack products such as Japanese Wasabi peas. Here at home, they are mostly consumed as mushy peas, a side dish that accompanies the English traditional dish of fish and chips, a favorite at seaside resorts.

But the food ingredients business is the growing part of the market “I think people directly eating mushy peas isn’t going to be the way,” said James. “It’s going to be protein extrusion into added value products – I mean Burger King has just launched a meat-free burger using protein isolates.”

Protein Isolates

According to Market research company Nielsen, Meatless Farm is the fastest growing UK brand in a sector that is seeing annual growth of about 10 percent. Global demand for plant-based protein – dominated by the USA giants Impossible Burger and Beyond Meat – is predicted to be UK£4.1bn this year, from UK£2.9bn in 2015. It says sales have nearly tripled – up by 179 percent year on year driven by health, environment and welfare reasons, and more than a third of Britons say they have eaten more plant-based food while confined to their homes.

Other highly developed countries with health-conscious populations are seeing similar trends. According to Buhler, the Swiss-based market leader in pulse processing equipment, total worldwide consumption of pulses is presently growing at 4 times population growth, and significantly, there's a whopping 16 percent increase in production of pulse flours and protein isolates in South East Asia.

These flours and high value protein concentrates are being used as wheat alternatives in products such as snacks, pasta and noodles and in the high growth sector of plant-based meat alternatives.

Clearly though, the greater the protein extraction, the greater the amount of starch flour left remaining and there must be a market for that to make the process viable: with protein isolates of 85-90 percent, that's a lot of pulse flour looking for a product.

Research and development is shifting more towards products that actually look and feel like meat textures, rather than mince and burger products. The technology has even given rise to its own name: 'Texturizing' (a conflation of texture and extruding) simulates the fibrous structure of animal muscle by passing the concentrated protein flour through a nozzle under enough pressure and heat to modify the molecular structure of the protein, rather unappetisingly known in the industry as 'wet texturates' or 'meat analogues'.

The opportunity for millers?

Seeking to capitalise on this South-east Asian trend, Buhler, together with flavouring



James Maguire of UK Pulses

market leader Givaudan, have just opened a plant-based food laboratory in Singapore. This food innovation centre aims to draw from the vibrant population diversity to develop new innovative products in Asia, for Asian populations, using protein-rich ingredients available in the region.

Buhler assert that plant-based food alternatives will only achieve the desired impact on the environment if their production can be scaled up for mass-market adoption. Their pilot-plant has been uniquely designed with that factor in mind, so new products created at the innovation centre could be replicated on larger industrial lines.

Other countries looking to capitalise on the plant-based protein boom can learn a lot from Canada, now the world's largest exporter of peas and lentils, which has positioned itself on

the forefront of this rapidly growing industry. Protein Industries Canada (PIC) is an industry-led, not-for-profit organisation aimed at positioning Canada as world leader in plant-based protein production. PIC, along with partnering companies including film director James Cameron, has invested a staggering CA\$272M (UK£156.5M) into plant protein production, including the processing of pea, lentil and fava bean protein concentrate into high-moisture meat analogues, texturised pulse protein, tofu, pasta and other non-dairy equivalents.

On our doorstep, France is the largest producer of pulses in the European Union. Speaking at a virtual event on World Pulses Day, France's Minister for Agriculture and Food, Julien Denormandie, said that protein crops, especially pulses, were the crops of the future. He noted that France's objective was to increase areas planted with pulses by 40 percent over the next three years.

Plant to plate

A UK pulse revolution would likely require significant state intervention, perhaps even a cultural epiphany to shift diets away from the traditional 'meat and two veg'. As James Maguire explains: "The problem in the UK is consumers have a preconception of what a sausage looks, tastes and smells like and they [meat analogues] don't do that. If we model it as a different product, you wouldn't have that, and you'd probably enjoy it more. I think that's going to be the major obstacle to be overcome, it's going to be for the supermarkets to engage directly with the consumers." We say, watch this space.

Pulses UK and its partner organisations are presently lobbying the UK's Department for Food and Rural Affairs (DEFRA) for incentives to help boost the home-grown plant protein business. DEFRA can be successfully lobbied because they are a cross-party organisation, not prone to election short-sightedness: "Our pitch to the government



Editorial has been extracted from the publication

is that they should help the industry to build these protein extrusion factories here,” added James.

As a crop, pulses can help the UK Government reach its stated aim of carbon neutrality by 2040, not only because pulses require less fertiliser, but because the milling wheat, that can be rotated on the same soil, also requires less. The UK is also well positioned to supply pulses into international supply chains thanks to first class traceability with the Red Tractor scheme. According to James, traceability of UK food is far better than our European counterparts. But at present there no large-scale protein extrusion facilities in the UK, and no plans to diversify.

Peas are the preferred option for high value protein concentrates and the UK has sizeable, viable, growing areas: “It makes sense, geographically to site processing here. Combinable peas, sown with the standard drill, combined in the standard way - the kind of rotation farmers will be used to - there's no new equipment they need. And that's a real positive because some of these niche crops will require equipment that farmers won't be used to, but peas can be treated just like any other wheat crop.” James explains. This is a sector where the UK could be capitalising on process technology to boost export revenues with value added products.

If governments can't see the opportunity to enter the protein food boom there are investors queueing up to capitalise. Syngenta Ventures is just one of many global specialist agriculture venture capital groups seeking to invest in niche enterprises that share its vision of producing more crops with fewer resources, especially those looking to capitalise on the demand for plant-based protein. The company is presently looking to identify and invest in promising startups to accelerate and capitalise on the growth of this sector.

The technology required is some way beyond that of milling grain into flour, but it's not simply a bolt-on ancillary to the milling process. This not an insurmountable task, far from it. If the automotive industry can diversify from combustion engine to electric motor, the milling industry can diversify its product lines to include pulses.

Indeed, the miller remains in the best position to capitalise on this opportunity. It isn't a bleak outlook for traditional wheat and meat-based products either as demand for their products will continue to rise to meet demand, however there's no escaping the fact population growth means there will have to be alternative sources of protein and millers are ideally placed to provide the processing muscle needed to satisfy this emerging market.

Millers will need to tap into specialist knowledge and expertise equipment suppliers, such as Buhler, to redirect the industry and make it fit for purpose for the second half of this century. Large scale capital equipment is needed to convert pulse crops into high value flours and meat analogues, but crucially it requires a kind of joined-up thinking and innovation that only vision and investment can bring.

Humans need alternative and sustainable protein sources to feed our burgeoning population, that much is clear. The plant kingdom and its infinite diversity holds key to the future, but to save the planet, plant-based protein needs to be cheaper and more available. As consumers we'll need to develop an open mind and a taste for wheat and meat alternatives. That means many more policy-makers of developed countries recognising the potential of the pulse.

How to make meat analogue

There are two major methods of extracting the pulse protein: Dry and wet. Both methods use the difference in size, shape and density of starch and protein containing particles. Starch particles tend to be larger and heavier than protein, thus air classification, a separation method based on density difference, has been proven efficient to produce flour with concentrated protein and starch.

The protein isolate is obtained by a process including an additional liquid phase. First, during the dry process, the outer shell of the pea (essentially consisting of insoluble fibres), is removed by mechanical action. After milling, a flour containing soluble fibres, starches and proteins is obtained. Being water soluble, pea proteins are therefore separated from fibre and starch by wet filtration and centrifugation.

The protein is precipitated to its isoelectric point, and then solubilising the dry spray, it forms a white powder of purified protein that can be used in human nutrition.

The obtained isolate has a protein content of about 85 to 90 percent. It is marketed as such or can be modified to optimise its technical or nutritional properties through extrusion cooking process, which allows pea protein to be crisp or texturised.