Sustainable savior

David W. Smith explores why pulses are good for the health of both people and the planet, and whether supply can meet the growing demand as the popularity of plant-based foods soars

Sustainable food production has become ever-more urgent. Already two-thirds of the global population is undernourished, or obese, according to the United Nations. The humble pulse provides one of the most important solutions for food security.

For centuries, pulses have been an ingredient of recipes worldwide, such as Indian dal, French cassoulet, Italian soups and bean salads, Middle Eastern falafel, as well as South American and Mexican stews. They are nutritious, relatively cheap, consume far less water than livestock and are kind to the soil. "They should be labeled a 'superfood' as they have positive impacts for humans, animals, and the planet," says Julie Cleijne, CEO & Founder of Sustainable Kitchen Consultants, a team of sustainable chefs who are specialists in creating sustainable menus with a focus on low-carbon, seasonal, plant-based and 'free-from' allergen ingredients. "We use them for their health benefits, being strong in fiber and protein, folates and phytonutrients. But we also use them to provide texture, binding, creaminess, and mouth-feel and taste. And they're easy to dry and store. Countries such as India and Nigeria have used the same traditional methods for centuries."

Pulses put to good use

Part of the legume family, pulses also protect soils from degradation. They are good at nitrogen fixation, so grow in low-nitrate soils and require less fertilizer than other crops. "Using less fertilizer means lower energy consumption and less dependency on fossil fuels, as well as lower production costs," explains Mathilde Alexandre, Senior Project Manager at ProVeg, a consortium member of the Smart Protein Project – an EU-funded initiative to develop cost-effective, nutritious and sustainable plant-based products.

Nitrogen fixation naturally nourishes the soil as some of the nitrogen is absorbed and becomes available for other crops. "Nitrogen fixation is responsible for the high protein content of legumes, as nitrogen is an essential part of the amino acids that form protein," Alexandre adds. "And soils are better able to retain water and nutrients – carbon and minerals – which increases resilience to the adverse climate events that are growing exponentially."

Travel expense

Despite the advantages of pulses for the environment, their global footprint is not negligible. They are transported thousands of miles from major producers such as India and Canada. "Quite often, red lentils are grown in Canada then shipped to Turkey to be processed, before being sent to the UK, or elsewhere," reveals Franek Smith from Wherry & Sons, a supplier of organic pulses and grains. "More local production reduces emissions. It's more sustainable than relying on a few producers, especially with global warming. Last year, Canada's pulse yield was about half the average." Smith also suggests that soaring container freight costs have made imports far costlier.

“Agricultural landscapes are becoming more homogeneous, and wheat and other cereals reign supreme. We’ve seen a big reduction in the area cropped with grain legumes, especially pulses”

***Mathilde Alexandre**, Senior Project Manager, ProVeg International*

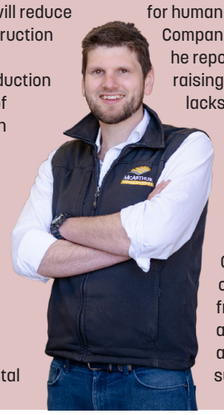
The nitrogen-fixing properties of pulses improve soil fertility, so can increase and extend the productivity of the farmland
(Image courtesy of M Barratt/Shutterstock)

A DIFFERENT APPROACH

McArthur Agricultural, which designs crop processing and storage systems for farmers, is developing a system for pulses that will have a beneficial impact on the UK pulses market. “Our processing system will help to replace imported soybean meal used in livestock,” says John McArthur, Managing Director. “It will reduce the environmental destruction associated with South American soybean production and drive the benefits of including more pulses in UK arable rotations.”

Research shows the validity of the approach. The Green Pig Project tested three types of pelleted feed made from soya bean meal, peas, or fava beans on 1,230 pigs. Feeding pulses had no detrimental impact on performance, carcass weights and back-fat measurements. “Livestock farmers can reduce their environmental impact and add value using feed containing homegrown pulses they can process themselves.”

Meanwhile, McArthur says it’s also important to grow the home market for human consumption of pulses. Companies such as Hodmedod’s, he reports, are doing a great job in raising the profile, but the market lacks scale. One idea is to shorten supply chains. “Processing should happen on or closer to the farm. This will strengthen the relationship between farm businesses and rural communities. Consumers will see they can buy environmentally friendly, locally produced and processed products via a shorter and more resilient supply chain.”



But legumes, including pulses, are usually imported into Europe from Asia, Africa and America. In the West, they are considered ‘orphan crops’, meaning underdeveloped and under-researched. They are not cultivated according to modern agricultural methods and yields are below potential. “Although crop diversification is important to sustainable agriculture, over the past 60 years Europe has moved in the opposite direction,” continues Alexandre.

It has favored a few cereals (maize, wheat, and barley) and oilseeds (canola and sunflower). The acreage of protein crops such as peas and fava beans was considerable in Europe in the early 1990s but collapsed as prices fell or subsidies were banned. “Agricultural landscapes are becoming more homogeneous, and wheat and other cereals reign supreme. We’ve seen a big reduction in the area cropped with grain legumes, especially pulses.”

Farmers are locked into the food supply chain as most research is based on major cereal or bio-energy crops. Alexandre says “farmers’ lock-in” is also caused by high specialization downstream in the supply chain. Cereal selection and storage plants are generally unable to manage legumes. The majority of facilities are designed for cereals or oilseed crops for biofuel. “That’s why the Smart Protein Project aims to explore the crop suitability and processing quality of quinoa, fava beans, lentils and chickpeas in seven representative pedo-climatic zones, using organic regenerative farming systems.”

Are pulses a safe bet for farmers?

In the UK, a similar scenario plays out. The maritime climate makes yields variable and not all varieties grow. But fava beans and varieties of peas do well. As in many countries, pulses were stigmatized as ‘poor man’s meat’ by the 18th century. Although awareness of health benefits and environmental impact are transforming these prejudices, UK farmers are reluctant to commit to planting peas, or beans, as a result of inconsistent yields, and Wherry & Sons’ Smith would like to see a subsidy system.

“Sourcing from local farmers reduces food miles and brings biodiversity to farms, which is great for food security,” notes Smith. “But farmers are too worried about the bottom line to grow peas. Whereas with wheat you might get 10% variability, with peas you could double the yield one year and halve it the next. Farmers say they would rather visit a casino than grow peas. Subsidies would help as farmers would be sure of an income.”

However, ProVeg International’s Alexandre argues that the UK’s cool and wet climate is particularly suitable for pulses such as peas and fava beans, which usually enjoy high yields of 3-3.5 metric tons per hectare. “If production were boosted to increase domestic consumption, there would be less reliance on global supply chains of key cereal and oilseed crops that are vulnerable from the Ukraine war and the risk of food shortages,” she says. Meanwhile, local pulse production could be used for animal feed to reduce the enormous amount of soy imported from Latin America, where land-use changes cause deforestation and GHGs.

470 million acres of pulse crops contribute to as much as **seven million metric tons of nitrogen** in soils around the world every year

(Inset above) The star of this risotto is buckwheat, considered a superfood as a result of its rich content of immune-supportive nutrients and antioxidant properties (Left) The specific functionality and nutritional aspects of the fava bean make it work well in plant-based meat
(Image courtesy of Sustainable Kitchen Consultants)

The UN Food and Agriculture Organization devoted a year to pulses in 2016 to raise awareness of their importance in global nutrition. White beans are packed with folate, vitamin B1 (thiamin), potassium, magnesium and iron

(Image courtesy of Sustainable Kitchen Consultants)

A global switch to veganism would deliver the largest emissions savings out of any dietary shift, preventing some **eight billion metric tons of CO_2 emissions annually by 2050**

Food companies are turning to protein from the yellow pea as the key ingredient for plant-based foods including burgers, bacon, tuna and yoghurt

(Image courtesy of Mykhailo Pavlenko/ Shutterstock)

"Farmers say they would rather visit a casino than grow peas. Subsidies would help as farmers would be sure of an income"

***Franek Smith**, Associate Director/Senior Trader, Wherry & Sons*

"This would not only protect ecosystems and ensure their capability to provide food, but also reduce price fluctuations for the UK animal agriculture industry," she adds.

The alternatives

Despite the reluctance of UK and EU farmers to grow pulses in larger quantities, the market for using them as alternative proteins in plant-based foods and meat-free meats is expanding rapidly. The Smart Protein project compiled a report on plant-based consumption in 11 European countries between 2017 and 2020. Every country reported an increase, with a huge 49% growth across Europe, reaching total sales of €3.6 billion (US$3.56 billion) in 2020. The German plant-based meat sector grew by 226%, reaching total sales of €181 million (US$179.1 million) in 2020. Meanwhile, a European survey by ProVeg International showed a significant shift toward plant-based eating. The survey asked more than 7,500 people in 10 European countries about plant-based foods. Almost half – 46% – said they have reduced meat consumption significantly. Around 40% of European consumers intend to consume less meat in the near future and almost 30% plan to consume substantially more plant-based dairy and meat products.

"We're seeing contrasting trends in the developing and developed world," says Cindy Brown, President of the Global Pulse Confederation (GPC). "In developing countries people who typically get protein from pulses want to eat a more Western diet with more meat. But we're also seeing a shift toward increased pulse consumption in developed countries where populations are shifting to a way of eating that is beneficial both to their health and the environment."

The protein factor

Much of the global demand for pulses is driven by traditional recipes, but there is a wealth of innovation taking place as dietary habits change in the West. Milan Shah, Director of Legumology – which offers whole and milled ingredients based on pulses and specialty crops – says there is a lot of research into pulse flours for use in baking. Various techniques can be used, for example, to make the pulse flours sweeter. The fast-growing trend to eat meat substitutes is one of the most striking developments. "In the 1980s, Burger King served a veggie burger and there was no attempt to make it taste like meat," explains Shah. "But only a minority – maybe 5% – are pure veggies and never look for meat substitutes. Another 50% are looking for a meat analogue. Meat substitutes have grown exponentially in the past decade and taking protein from yellow peas works particularly well for these products rather than from rice, soya, maize or wheat."

Another innovation is the development of a high-protein lentil milk by the EU-funded Protein2Food project. "It scores as highly as other milk alternatives in sensory tests, with about the same protein content as cow's milk," reveals Alexandre. Meanwhile, lentil protein isolate has been used in a new infant formula that meets EU requirements and could potentially replace soya formula,

THE RETURN OF PEASANT FOOD

The cost-of-living crisis provides another reason to eat pulses. Sadly, as Milan Shah points out, many people haven't got a clue how to cook them. "During the pandemic we supported food banks with large batches of hummus made from chickpeas. And we also taught people how to make dal and rice, which is easy, cheap and nutritious," he says.

It was a similar story when Shah visited food banks in Southern France. "They had recipes with pulses that they called 'peasant food', which people in the countryside have cooked for generations. They're low cost and nutritious, but greater meat consumption means people have forgotten how to cook them," he says.

Franek Smith says the UK Pulses Association spent thousands of pounds developing simple recipes with pulses. "We did a social media campaign but penetration was the biggest issue. It's difficult for people to think outside the box on peas and beans as we see them as dal, or Mediterranean food."

Meanwhile, Sustainable Kitchen Consultants provides training in plant-based cooking, often using pulses. They teach chefs that pulses can achieve strong flavors because they absorb spices and herbs very well. CEO Julie Cleijne also says they point out the advantages of pulses in creating gluten-free meals and as alternatives to dairy.

As well as being a star of any dish, pulses are 'climate smart' as they simultaneously adapt to climate change and contribute toward mitigating its effects

(Image courtesy of Sustainable Kitchen Consultants)

"There is a wealth of research going into developing pulse seeds that are better equipped to combat food insecurity, varieties that are more drought-resistant or have a higher protein content"

***Cindy Brown**, President, Global Pulse Confederation*

When made right, by wet fractionation for burgers and dry process for ground beef, pulses can taste identical to animal-based meats

(Image courtesy of Sustainable Kitchen Consultants)

Pulses such as peas and lentils produce some **0.9kg of CO_2-equivalent for every kilo grown**

MEAT CONSUMPTION AND THE ENVIRONMENT

A 2021 study published in *Nature* revealed that livestock farming is responsible for 57% of all food production emissions, with 29% from plant-based foods. The United Nations says livestock contributes 14% of all man-made greenhouse gases, including methane, which is 34 times more damaging than CO_2.

A 2020 report from IDTechEx described the meat industry's land-use as 'unsustainable' and disproportionately large. Despite using 77% of agricultural land, only 17% of global caloric consumption comes from animals.

Meanwhile, the World Wildlife Fund (WWF) says beef and soy production are responsible for deforestation in the Amazon Rainforest and other areas of Brazil, Argentina and Paraguay. Often, deforested areas are cleared using fire, releasing huge amounts of CO_2 while removing a CO_2 sink.

Meanwhile, the EU says the average water footprint per calorie for beef is 20 times that of grain. Producing a kilogram of beef takes an average of 15,415 liters of water. The same amount of sheep or goat meat takes almost 9,000 liters, a kilo of pork 6,000 liters, and chicken 4,300 liters. In all, 92% of the global water footprint goes toward agriculture, 29% of which is used in animal production.

while fava beans were found to be a great addition for protein-rich bread and pasta. Compared with traditional dairy proteins, Alexandre says lentil-protein isolate has a low carbon footprint, and can replace eggs in baked goods or act as an emulsifier in salad dressings. Lentil flour is also involved in the production of gluten-free crackers.

Another goal of the Smart Protein project is to isolate chickpea protein and create high-protein plant-based meat alternatives.

Julie Cleijne says Sustainable Kitchen Consultants has created a range of plant-based burgers for a well-known London burger chain that are launching this year. The recipes use UK-grown pulses in a creative way, with fermented fava beans and chickpeas for umami flavors, heritage carlin peas, and a creamy 'peacamole' using UK-grown peas as an alternative to guacamole. "We'd love to see more of this, with chefs and recipe developers using pulses not just as binders and for functional ingredients, but as the stars of a dish. The plant protein market will drive an increase in demand for peas, particularly white ones. Many companies are turning to white pea protein as it affects the color and taste of the final product as little as possible."

The international cooperative, Limagrain, considered growers' concerns when developing its new pea variety, LG Aviator. Launched in 2020, it holds its pods toward the top of the plant, making it easier to combine. The company believes it produces more even-maturing peas because the pods get much more sunlight.

We're in a fight for the dirt

A more time-honored technique is 'Three Sisters' – intercropping of beans, squash, and corn. "Beans naturally absorb nitrogen from the air and convert it to nitrates, fertilizing the soil for the corn and squash," reveals Giacomo Ranalli, Sustainable Supply Manager for Sustainable Kitchen Consultants. "In return, they are supported by winding around the corn stalks. The squash leaves prevent weeds from taking over the field. These three plants thrive together better than they do planted alone."

The growing Western habit of eating more plant-based food is bringing new opportunities and the GPC's Cindy Brown describes the amount of innovation as "incredible". "Pulses are being used in myriad applications to provide sustainable, plant-based alternatives to animal products. There is also a wealth of research going into developing pulse seeds that are better equipped to combat food insecurity, varieties that are more drought-resistant, for example, or have a higher protein content."

But pulses are often competing with other crops for land. "We are in what I call a 'fight for the dirt' – competing with other crops to get growers to grow more pulses," Brown concludes. "Especially now, with global prices for wheat and canola so high. That, the container crisis as well as inflation raising food prices, are our biggest challenges." **FOFP**