

NEW HORIZONS FOR THE KING OF BEANS

James Cooper looks at the rise and rise of the humble soybean: Will there ever be enough soy to satisfy our endless hunger for meat?

Image: Soya growing in Hertfordshire 2021 - photo courtesy of Soya UK

My Dad once had a T-shirt with an engineering flowchart printed on the front. It was brilliant because it solved all the fundamental questions of mechanics by reducing any problem into two essential conditions: Does it move, or should it move; a simple yes or no. In the final analysis the answer is beautifully provided by either Gaffer tape or WD40. For us simple humans, there's something so reassuring about simple practical solutions to complex problems. Once we've settled on a great solution, we tend to stick to it. For the meat industry, that universal remedy is soya.

Most supermarket shoppers browsing the fresh meat aisle, deciding what to eat for dinner, beyond the consideration of fish, pork, chicken, beef or lamb and perhaps how best to cook it, may give little thought to what that creature has eaten itself, or how its diet may have changed over the years.

It's a simple fact that, farmed animals require a varied and nutritious diet containing complete proteins, to grow and be healthy, so that we can in turn consume them.

Surprising then that some consumers want chicken fed nothing but corn, believing it to be somehow better, or because it makes for a nice yellow colour when really a bird raised on corn alone would be slower growing, possibly malnourished and probably as a layer wouldn't produce as many eggs.

For the most part modern farm animals have moved on from food wastes, grubs they picked out of the ground, grass on a hillside, supplemented with bits of feed here and there. Like so many modern humans production animals eat an entirely industrialised diet, brought to the farmer in bulk. And although the form of that diet has evolved, the building bricks have not: they need protein in whatever form that provides the best value for money.

There are doctorate degree programmes covering the bewilderingly complex subject of feed technology; a chemistry

focussed purely on increasing the nutrient efficiency of feed.

Indeed, more is known today about animal nutrition than human nutrition.

Thankfully, we have learned a few lessons about where to source valuable proteins in our attempts and failures to oversimplify industrial food production. Prior to 1988 the thinking was along the lines of: is it a protein source, yes; can humans eat it, no; therefore, we may feed it to animals. But the outbreak of BSE, later linked to Creutzfeldt-Jakob disease in humans, quickly brought that logic to a grinding halt. What we did start grinding however, in increasing quantities was one of the cheapest alternative sources of protein and one that's now absolutely crucial to the world's farmers and consumers - soybeans.

Thanks to USA agribusiness, we have developed an apparently insatiable global appetite for the bean produced in vast volumes by farmers in the Americas. If you were to create a flow chart for what to feed farm animals, all routes would lead to soy. What's quite amazing is that the many natural limitations in protein absorption, especially infant growth of monogastric animals (chicken, pigs), are unlocked by feeding that animal some proportion of soy. It is the number one, cheap and plentiful, source of vegetable protein necessary for fulfilling the genetic

Figure 1: Soybean production in tonnes - Source: Our World Data

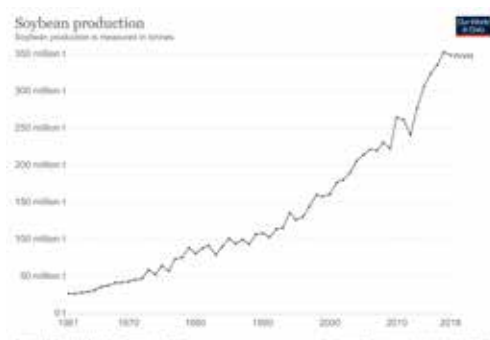




Figure 3: Hidden soy in human diets: an estimate of the amount of soy used to produce each products, i.e. the soy footprint of each product - *image courtesy of efeca and Soy Tool kit*

Source: WWF (2019)⁶

potential of that animal, enabling rapid meat production. And ruminants (dairy and beef cows) too can convert this highly available protein directly into milk.

Thanks largely to soy, combined with rapid breeding techniques, meat today is grown faster than ever.

The most extreme example is the modern broiler, which by any standard is something of a genetic oddity. It has been bred to transform from a fluffy chick the size of a golf ball to a 1.6kg carcass on a supermarket shelf in about 10 weeks. In order to fulfil this amplified genetic potential we've given it - of nearly doubling its body mass each week and producing enormous chicken breasts that consumers now expect - it requires an equally modern, high-protein, rocket-fuelled feed.

It all comes down to soy's magic amino acid profile: soy protein is what's often referred to as a 'complete protein' in that it meets all the essential amino acid requirements to support normal growth in animals and humans alike, making it an ideal protein source to boost the nutrient density of compound feeds. It's this protein, which accounts for 35 percent of the raw bean prior to further processing, which has made the global factory farming of livestock for cheap meat (and to some extent farmed fish such as salmon) a possibility.

The evolution of and distaste for soy

It's not an overstatement to say that the discovery of this stable, cheap source of protein has been something of a miracle for human food production. During the First World War soy was crushed to make oil for human consumption and to make explosives.

The Americans had begun experimenting with using the protein meal as animal feed, but farmers were reluctant to take it up because it was indigestible to chickens and pigs. Then in the 1940s the industry worked out how to deactivate the enzyme inhibitor in the protein meal sufficiently for animals to tolerate it, and technology taken from the Nazis at the end of the Second World War solved the problem of the oil's horrible smell and flavour and bingo; As American taxpayers' money was ploughed into subsidies, exports soared.

Until 2003, the USA was the largest exporter of soy. But through the 1990s, multinationals promoted the expansion of the crop in Latin America, financing farmers and building the infrastructure for soy exports. The obvious attraction of Latin America was cheap land and labour. Today, Brazil and Argentina are the largest exporters of soy.

And yet ironically, for the unwitting consumer who wants an abundance of cheap meat that we now have, soy is a dirty word: it's associated with for historic and ongoing climate change and deforestation. The popular rhetoric is of environmental and human exploitation all backed by Big Ag and greedy governments. And of a monoculture spreading over huge expanses of the Americas, indiscriminately wiping out forests, wilderness and species as it goes.

And it gets conflated with GMO and American-style agribusiness such as Monsanto, with its 'round-up ready' varieties (glyphosate tolerant), killing pollinators, social issues in Brazil, etc, etc. The list goes on.

Add in the fact that soy is considered one of the most important food allergens (soybeans and its products are listed in Annex IIIa of the EU directive on labelling of foods), yet perversely the soybean is one of the most difficult foods for the allergic consumer to avoid as it is used in so many processed foods. It's the classic 'hidden allergen.' For the consumer, all these issues get melded into a soup of general distaste towards soy. Pretty much any dirt the media and/or environmental campaigners want to throw at it, will stick.

The World's Soy: is it used for Food, Fuel, or Animal Feed?

Shown is the allocation of global soy production to its end uses by weight. This is based on data from 2017 to 2019.

Our World
in Data

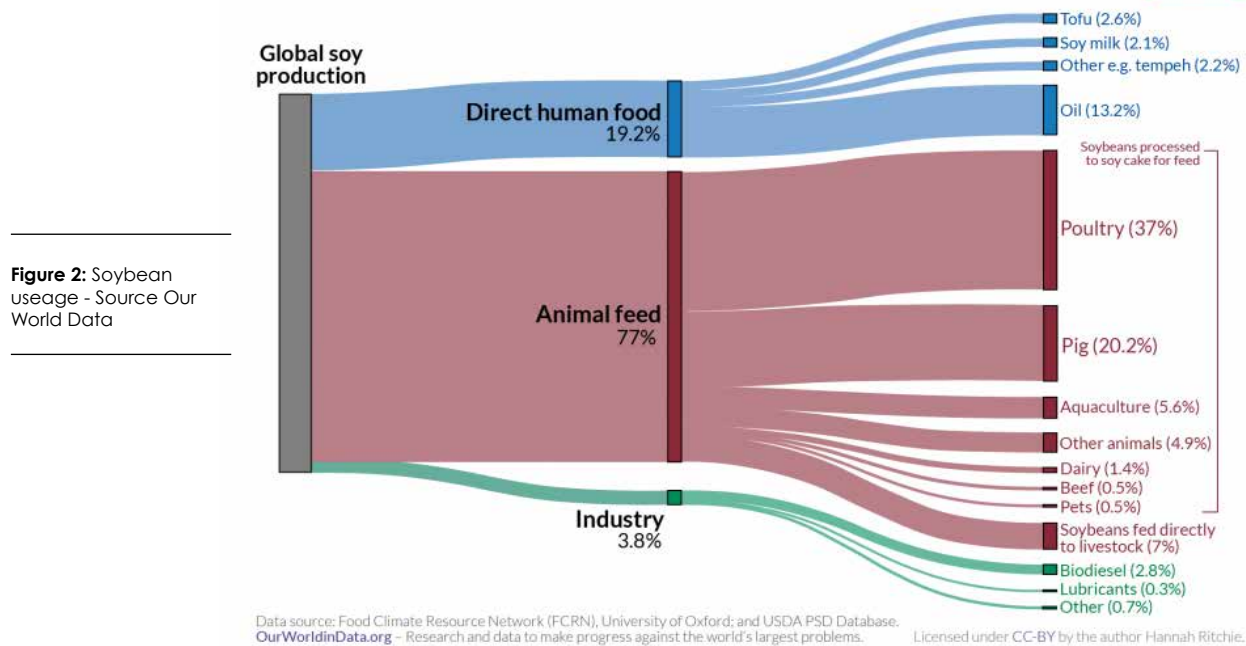


Figure 2: Soybean usage - Source Our World Data

Too good at what it does

Nor is eating less meat the simple answer.

Critics of meat consumption often argue that it takes too much feed to produce animal protein and that we should instead simply feed humans what we are feeding livestock.

But this argument spectacularly fails to account for the large percentage of non-human edible materials that are fed to livestock around the world. Of course, animals don't just eat protein, they need a compound made up of other grains, fibres, energy and vitamins/minerals and to make up a balanced and healthy diet for healthy digestion and rounded nutritional profile.

The plant-based industry wants you to believe that crops like soy, corn and barley, are mostly being fed to livestock, but according to the United Nations FAO, grain makes up only 13 percent of global livestock feed.

The trouble is, soy's too good at what it does and so the world can't get enough of the stuff. The modern meat industry is now almost entirely dependent on it and yet still hungry for more.

Few of us are even aware of how much soy we eat - because we tend to consume it indirectly. Soy oil is used for cooking and can also be found in margarine, chocolate, ice cream or baked goods, as well as in cosmetics and soaps. It doesn't appear on the list of ingredients on a packet of pork chops for example. We may not eat large quantities of soy directly, if at all, but from the animals we eat or from the eggs or milk we consume.

No less than 80 percent of the world's soy is now fed to farm animals and the proportion and protein concentration of soy present in animal feed varies considerably across different types of livestock and their growth period.

Poultry and pig feed contains the most soy, followed by cattle (dairy and beef), farmed seafood and lamb. According to the British Poultry Council over a billion birds are reared for meat every year in the UK and its popularity is growing by three-to-four percent annually, with each of us eating over 26kg of poultry annually. According to the Agricultural Industries Confederation (AIC) data, the poultry industry used more than two-thirds of the soy imported into the UK last year.

Last year 3.5m tonnes entered the UK, either as unground beans or as crushed meal. And in the EU, in 2019, approximately 30m

tonnes were imported. But there is pressure to reduce imports and become more self-reliant on home grown protein because of ongoing traceability problems of soy linked to deforestation.

George White of GLW feeds in Leicestershire (UK) is quick to defend UK soy imports because they are dwarfed by Chinese imports. "You've got to get this a little bit into perspective, one boat a month comes to the UK, and more than one a day goes to China," he points out. I checked; he's not exaggerating.

Chinese consumption driving demand

In 2006, to feed demand, new agricultural frontiers were opened up in Brazil, with large areas of virgin rainforest illegally felled to make room for the crop. US-based transnationals started exporting soy back to China, the country from which it originated, as newly urbanised Chinese switched to industrialised western diets.

The burgeoning Chinese middle class has since led to explosive increases in domestic consumption of meat, most notably pork. And because of the immense growth of the domestic pork industry in recent years, China is now home to more than half the world's pigs - most of which are fattened up on a steady diet of soy meal. The outcome of this is that China now accounts for 60 percent of the world's soybean imports, a figure tipped to reach 70 to 90 percent by the end of the decade.

And nobody really knows where China's appetite for soy will end, only to say that the Chinese market has been hoovering up soy at an alarming rate and there's no end in sight. More concerning still, perhaps, is that peak demand for soy is still some way off.

In 2020/21, China imported 100m tonnes of soybeans, while the global soybean import volume amounted to around 166m tonnes (Statista). Data shows that soy production has more than doubled over the last two decades but, if global demand for meat grows as expected, soy production would need to nearly double again by 2050.

Donald Trump's recent trade war with China has further reshaped the global market for soybeans, with produce diverted from Brazil - originally intended for Europe - heading towards China.

Pressure on Sustainability

Meanwhile, in Brazil, the continuing rule of President Jair Bolsonaro, heavily criticised over forest fires, has heightened anxieties amongst environmental groups.

President Bolsonaro has defended the legal deforestation of land for agriculture, rolling back environmental policies that have contributed to deforestation reaching a 12-year high in 2020. According to Reuters, recent data shows that 2020 was yet another bad year for the Brazilian Amazon. Destruction of the rainforest increased by 13% percent, despite the Covid-19-induced global economic downturn.

UK concerns and the Roundtable on Soy

Figures based on data collected by the AIC and published by the government funded UK Roundtable on Sustainable Soy (RTSS, not to be confused with the RTRS), show that nearly 40 percent of soy imports in 2019 – 1m tonnes in total - came without any sourcing requirements from Argentina, Paraguay or Brazil. While some research suggests the risk of deforestation could be as low as six percent, it's unknown whether this soy is linked to deforestation.

All this may reinforce the impression that deforestation is a necessary evil to feed growing global populations, but it's not necessarily the case.

The RTSS was established in 2018 to start a dialogue and incentivise on sustainability. Members include traders, feed industry, meat and dairy producers, food service and most major UK retailers.

It is part of the broader UK Sustainable Soy Initiative, which also includes an outreach and engagement programme across Europe and beyond, aiming to help drive a global mass market transition to sustainable soy supply chains.

“Compared to when the UK Sustainable Soya Initiative began, we are now able to say much more about where our soya comes from, and whether forests or native vegetation in those geographies may be at risk of conversion. The volume of soya imported by the UK covered by a deforestation and conversion free certification scheme has more than doubled in just two years”, said Francesca Marietti, Consultant, EFECA, the consultancy firm helping to coordinate the roundtable.

“A couple of years ago, certified soy production was greater than demand for it, but growing action from industry, supported by the rise of sustainability initiatives in consumer countries, has now resulted in a clearer market signal that the supply of sustainable soy needs to increase together with demand for it”, Francesca added.



Changing attitudes in the UK?

“The lack of demand has been holding us up [but] we are now starting to see demand [for sustainable soy] come through,” said ForFarmers’ corporate affairs director, Nick Major, who is also president of FEFAC, the European Feed Manufacturers Federation.

Due largely to mainstream media scrutiny, much like what happened with palm oil, the consumer has made the connection between soy and what we eat, and food retail is representing these concerns.

Francesca explains, “In the UK, there was a growing need to act but the solution was unclear. Many consumer facing companies had made ‘no deforestation’ commitments and there was growing pressure from the public and NGOs. The retailers were the first to publish policies and time-bound plans (mainly in 2019), and this is now increasingly becoming a priority for other actors across the supply chain, such as food service companies, food producers, and feed mills.

“Despite the challenges of Covid and Brexit, UK industry

continues to explore how to achieve a mass market transition to sustainable soya.” she adds.

Pressure on feed costs

Another issue, according to FEFAC (European Feed Manufacturers' Federation), is that feed costs have increased more than producer prices over the last 25 years, confirming a general trend of a permanent pressure on our livestock farmers to improve productivity and on compound feed producers to deliver more efficient compound feed.

“Percentage inclusions [of soy] are certainly down, but they won't go away until we've got alternatives”, George White explains.

“Over this last winter, every other day prices were going up. Getting a return back in the marketplace is always lagging behind.” he adds.

“There'll be some consolidation of the industry I'm afraid to say, we have to really look at charging the right price for the (cost of) production in the UK if we're going to follow all the rules and regs that are set out. Food will become more expensive, and it has to if you want to keep agriculture running.”

“The big 'anti' seems to be coming from the ruminant sector”, explains George, “not a problem, we can milk cows without soy, cows understand amino acids not soy.” But, we can expect it to come at a cost.

Alternatives to soy?

“Some companies are using locally produced beans and pulses as a protein source in animal feed, but their protein content can be lower. We are also aware of some switching to alternatives like rape seed meal in dairy diets. However, it is unlikely these alternatives could commercially replace soy at scale. Research on insect protein is also underway, but this is still more of a future trend, rather than a current mass market alternative” says Francesca.

Insect protein is an emerging technology for pig and poultry feed (live insects and insect oil are permitted but not insect meal). But there are ethical and sustainability considerations here too, including what to feed the bugs on.

Other alternatives to soy are in decline, placing further reliance on soy. Global authorities, including the FAO, have deemed the practice of uncontrolled wild fish harvesting for fishmeal production – a key ingredient in young animal and aquatic feeds – as not sustainable for the long-term future.

The use of prime fishmeal in such diets for young animals has also declined because soy protein concentrate with comparable protein levels is cheaper. Other soybean specially-treated

products have also appeared with significant claims to replace fishmeal.

So, while there are alternative, even richer, protein sources available, economically and nutritionally, the oilseed meals (of which soy is the most dominant) are one of the best protein sources to be used in feed both in terms of concentration and quality.

A UK soy opportunity

Soybeans are not widely cultivated in the EU and, according to FEFAC, the EU has a low self-sufficiency in high protein feed sources, but things are changing.

One option the EU is keen to explore is to grow more soy domestically, where it is GM-free, fully traceable and not from deforested land. The EU's soy self-sufficiency is just five percent, so protection from the vagaries of sustainability and the rollercoaster market would also be very desirable.

David McNaughton of Soy UK has, for some years, been promoting the production of hard IP 'identity preserved', UK grown soy. Hard IP basically means non-GMO - read traceability and environmentally sound - as opposed to 'any origin', or untraceable. As consumer pressure builds on sustainability and in the face of rising soy prices, his planets may be starting to align.

So how can a subtropical plant survive, let alone thrive to be a profitable crop in the UK?

David explains that he has been steadily growing and breeding several strains of soy which are adapted to the UK climate from seed originally produced in the Ukraine.

“Two major things have changed and one of them is plant breeding, most of the old varieties would be no more suitable for the UK than the banana, forget it. But the new varieties will grow perfectly happily up as far north as Humberside.

“So, in the last 20 years, a bit like maize - a crop that was not viable in the UK at all - the plant breeders get hold of it and now maize is a huge crop in the UK”, David explains.

I wondered why David was getting involved in a crop with such a poor environmental reputation.

“One of the tragedies” he says, “is that soy is actually environmentally a really good crop in the UK context because it's nitrogen fixing, it doesn't need much fertiliser, doesn't really get any pests or diseases in the UK, so we don't have to spray it much with fungicides or pesticides.

“Yes, we do a little bit of weed control, but compared to all the other stuff it's really low input. The UK soybean has got excellent environmental credentials. The problem only comes when you chainsaw a rainforest to grow it, then it's not very environmental.”

From a carbon perspective, the nitrogen fixing ability of



Soy should not be underestimated. Not only does it produce enough nitrogen to feed itself, but produces extra over and above, leaving a nitrogen legacy of about 70 kilos a hectare in the ground, making the following wheat crop much more economic to produce and more environmentally friendly as well.

The other thing that's changed is the value of soy, which is what's really made it an interesting proposition.

If UK farmers aren't convinced by soy's green credentials maybe the financial rewards on offer will change minds. The figures speak for themselves: Profit margins last year were based on £370/tonne, this year David predicts prices of over £500/tonne for his hard IP UK contracts.

“Farmers can do a straightforward gross margin calculation and conclude that Soy is the most profitable break crop between wheat sowings.”

It's also a great alternative break crop to oil seed rape (OSR) which has seen huge decline from around 700,000 hectares at its peak to around 250,000 hectares today due to problems with the pesticide resistant ‘cabbage stem flea beetle’, which has demonstrated the ability to completely destroy a crop of OSR.

But even by his own admission David cannot replace 3.5m tonnes of imported soy.

“Even if soy replaced OSR, which was the number one break-crop, we'd still only produce one and a half million tonnes of soy, with the best will in the world we wouldn't even get halfway there, such is the UK dependency on soy.

“When you're talking plant derived, the only things that have got the protein density and amino acids are either of two species - one of them is soy, the other one is lupins,” he adds.

“People are generally ambivalent about lupins. They are

David McNaughton
- Photo courtesy of UK Soya



actually a tremendous crop. In the same way that soy is overdone lupins are tragically underdone. By right there should be a vast acreage of lupins grown because in many ways they're better than soy. There's a lot of people taking a greater interest in lupins now.”

So, would George White purchase David's home-grown soya?

Yes, he says. “But we don't buy the whole soyabean, we buy the meal. Somebody's got to crush it to get the oil out before we would want to use it.”

Given the high value of soy oil on the open market, this really serves to demonstrate the UK's – and possibly the EU's – opportunity for a more self-reliant approach to animal feeding.

Will there ever be enough soy to satisfy demand?

Who knows, maybe soy and maybe its traders really are the third horseman of the apocalypse, being closely followed by Armageddon. But in the meanwhile, sustainable opportunities abound for growers, buyers and millers for this precious bean.