

## Sustainable protein: Meeting future needs

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In recognition of [the need for sustainable food systems](#), the European Union has committed to reducing greenhouse gas (GHG) emissions, towards a more resource efficient Europe.<sup>1,2</sup> Animal farming is a major contributor to GHG emissions, so reducing the amount of animal products we eat (particularly beef), and increasing the efficiency of agricultural practices are important goals.<sup>2-4</sup>

Animal products (meat, fish, milk and eggs) are major dietary sources of protein, and could be partly replaced by more sustainable sources. Increased production and use of protein crops (e.g. soy and legumes) are part of the solution, but more intriguing sources are also appearing on shelves. Insects, algae, and duckweed are widely accepted in other parts of the world, but are relatively new to European tastes and unknown by many. This article highlights some of these unusual protein sources, and considers the rationale for their use, as well as potential legislative and marketing challenges.

### Edible insects

Insects have the potential to produce less GHG emissions, and use less resources, than conventional animal agriculture for similar amounts of protein.<sup>5</sup> Like most animals, insects are rich in protein and a number of essential amino acids.<sup>6</sup> The digestibility of protein from insects is higher than plant proteins and only slightly lower than egg or beef protein.<sup>6</sup> They are also a surprising source of dietary fibre chitin.<sup>7</sup> The nutritional content of insects can vary greatly by species, stage of growth, and feed. For example, adult mealworms are a source of iron, iodine, magnesium, and zinc; while larvae are rich in B vitamins.<sup>7</sup>

Many insect species are eaten around the world with little evidence of ill-effects, suggesting they are safe to eat.<sup>4</sup> Potential hazards (from biological or chemical contamination) are likely to depend on production, harvesting and processing techniques, and need a full assessment. More research is needed, for instance, into the potential hazards of farming insects fed on food waste (a potentially cost-effective solution).<sup>8</sup>

### Algae and aquatic plants

Algae can be broadly divided into microalgae and macroalgae (seaweed). Algae reproduce rapidly and have a higher productivity compared to conventional crops. They can be cultivated in bioreactors (microalgae), or in sea- and recycled water (macroalgae/seaweed), requiring less land.<sup>9</sup> Algae can accumulate minerals like calcium, iron and copper at much higher levels than land-grown foods.<sup>10</sup>

Some varieties of seaweed are relatively high in protein, low in fat, and provide vitamins and minerals, and some essential amino acids.<sup>10</sup> They are also one of the few plant sources of vitamin B12 – important for vegetarians and vegans – with a single portion of *Ulva lactuca* (sea lettuce) providing the recommended intake for adults.<sup>10</sup> Seaweeds are staple foods in Japan and Korea. They can easily be added to sushi bowls, pasta dishes, smoothies, and salads, while microalgae are commonly sold as food supplements (such as

spirulina and chlorella).

Duckweeds are small aquatic plants used as feed for domestic animals. They are also mixed into soups and salads in some parts of the world, particularly in Asia. Dried duckweed is a promising, fast-growing, high quality protein source (amino acid composition similar to meat), with up to 40% protein content.<sup>11,12</sup>

## Upcoming improved plant protein sources

Plant protein sources that are eaten widely include soy, wheat, vegetables, and potatoes. Rapeseed (canola) oil, popularly used in cooking, leaves behind a protein-rich ingredient when extracted from the seed. This rapeseed meal has been used in animal feed for a long time, but its use in human food has been limited due to its sensory qualities (e.g. taste) and potential contaminants.<sup>4,13</sup> New processing methods are in rapid development to boost the safety, nutritional and sensory potential of rapeseed protein.<sup>4</sup>

Researchers of the EU-funded [Protein2Food project](#) are improving the protein quality and quantity of seed crops (amaranth, buckwheat and quinoa) and legumes (lupin, chickpeas, faba beans, and lentils) underused in Europe. Developing varieties suited to European climate and soils, improving crop management, and technological innovation, will lead to new plant-based and protein-rich foods, such as meat alternatives, bakery products, pasta, breakfast cereals, and snacks.<sup>14</sup>

## Crossing the barriers

Plant [protein](#) sources tend to lack certain essential amino acids needed by our bodies. Hence it is especially important that [vegetarians and vegans](#) eat a variety of plant proteins (fruits, vegetables, grains, and legumes). Algae contains a rich amino acid composition, comparable to soybeans or eggs, however it's digestibility and bioavailability it not yet fully understood.<sup>10,15</sup>

For these novel foods, especially insects, to be introduced into the mainstream, they must overcome challenges like the "yuck factor".<sup>16,17</sup> Furthermore, a low awareness of the high environmental impact of meat production leads to low motivation to change eating behaviours.<sup>18</sup>

New regulations adopted in 2015 classify any food as novel if it was not commonly eaten in the EU before 1997.<sup>19</sup> These foods can be newly developed foods using new technologies, or foods traditionally eaten in non-EU countries.<sup>20</sup> The new regulation aims to increase the efficiency of the process to get innovative foods on the market faster, while maintaining quality and safety standards.<sup>19</sup>

## Conclusion

Substituting meat with other protein sources has the potential to improve the sustainability of the food supply in Europe. To unlock this potential, the most difficult task will be bringing about a change in cultural attitudes. How can we encourage people to be adventurous in their food choices, and motivate change in meat-eating habits?