

Peanut power

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Predominantly used in cooking, peanut oil is popular in a variety of global cuisines and has a low level of saturated fat. Sally Roberts looks at the properties and history of the peanut alongside its role as a feedstock for the first biofuel ever produced, and moves to develop a non-edible variety specifically for biodiesel production

Traditionally farmed as a food product for its flesh and oil, the peanut – or groundnut – provides heart-healthy oil with unique cooking properties popular in Asia.

Generally and, depending on where they are farmed, peanuts contain 45% fat and 30% protein and, when pressed, the oil produced comprises 48% monounsaturated fat, 34% polyunsaturated fat and 18% saturated fat. The residue remaining from the pressing process is rich in protein and commonly used as animal feed, ensuring that no part of the nut is wasted.

The oil's major component fatty acids are oleic acid (46.8% as olein), linoleic acid (33.4% as linolein) and palmitic acid (10.0% as palmitic). The oil also contains some stearic acid, arachidic

acid, arachidonic acid, behenic acid, lignoceric acid and other fatty acids.

The peanut is technically a legume (edible seed) rather than a nut, and is thought to have originated in South America. Bolivia, Brazil and Paraguay are today home to the greatest variety of wild peanut.

The earliest evidence of peanut farming was discovered in 2007 in the Nancho Valley of Peru. Carbon dating has revealed the peanut husks to be approximately 7,600 years old. These findings help reinforce the theory that the early development of agriculture and civilisation in the Americas took place in farming settlements across the Andes, and prove that peanuts were farmed, traded and considered a useful commodity from the beginning of the era.

An oil with over 300 uses

Peanut oil was first popularised in the 18th century as a result of the research – and promotion – of American inventor and agricultural specialist George W Carver. Carver realised that peanut crops could be planted in rotation with the popular southern crop, cotton, to replace the nitrate depleted from the soil. Southern farmers soon adopted this method and enjoyed the benefits.

While the majority of the peanuts produced were used as animal feedstock, a surplus began to build up. To combat this, Carver invented over 300 uses for the nut, ranging from the extremely useful to the outright bizarre, including peanut lemon punch, chilli sauce, caramel, peanut shampoo, shaving cream, hand lotion, insecticides, glue, charcoal, rubber, nitroglycerine, plastics and axle grease. Some of his inventions are still in use today; peanut oil, salted peanuts, peanut milk; and peanut oil is used as the main ingredient in ear-wax remover.

The US National Peanut Board (NPB) explains that peanut production grew in the late 1800s as the nut became more popular at circuses and with street vendors. However, at this time, peanuts were still harvested by hand, leaving stems and other parts of the plant in the peanuts. Thus, poor quality and lack of uniformity kept down demand.

Around 1900, labour-saving equipment was invented for planting, cultivating and harvesting, as well as for shelling and clearing the kernels. With these significant mechanical aids, demand for peanuts grew rapidly, especially for oil, roasted and salad nuts, peanut butter and candy.

In the early 1900s, peanuts became a significant agricultural crop when the boll weevil threatened the southern USA's cotton crop. Following the suggestions of Carver, peanuts served as an effective commercial crop and, for a time, rivalled the position of cotton.

Health benefits

A recent study released in the *American Journal of Clinical Nutrition* found that eating peanuts daily helps decrease blood pressure and cholesterol, regardless of flavouring.

"Peanut consumption offered significant benefits to participants with elevated serum lipids and blood pressure," says Dr Richard Mattes, professor of Nutrition Science at Purdue University.

Results of a trial that included over 150 men and women found that the blood pressure of all participants was decreased. The paper explains that these results may be due to the arginine, an amino acid found in peanuts, which "promotes the production of nitric oxide – a vasodilator that potentially leads to a decrease in blood pressure".

The Peanut Institute (PI) notes that USDA data shows peanuts contain more arginine than any other whole food, including other nuts. Ounce for ounce, it says, peanuts are the most nutrient-dense nut and contain more protein and arginine than any other nut. A PI press release states: "[Peanuts] consist of eight essential nutrients, are an excellent source of niacin and manganese and are a good source of fibre, vitamin E, magnesium, folate, copper and phosphorus. Peanuts also have

potassium, phytosterols, resveratrol and healthy fats, all of which may benefit health and may help prevent cardiovascular disease.”

A wide distribution

Today, major producing countries include Africa (northern and western regions) China, India and the USA (see Table 1, below), and the largest importers of the oil are Argentina, Senegal and Sudan.

The NPB says that, in the USA, four main types of peanut are grown. They include runner peanuts, which are uniform in kernel size (which allows for even roasting) and are the most commonly used for making peanut butter. This variety is typically grown in the states of Alabama, Florida, Georgia, Oklahoma, South Carolina and Texas, and accounts for 80% of the peanuts grown in the USA.

Virginia peanuts – the largest of all – are also known as the ‘ballpark’ peanut and are often used in gourmet snacks. They account for about 15% of total US production and are grown mainly in southeastern Virginia, northwestern North Carolina, South Carolina and west Texas. Virginia peanuts are popular and are used for all-natural peanut butter.

Spanish peanuts are known for their red skins and smaller sized kernels. Used predominantly for peanut candy, salted peanuts and peanut butter, the variety has a reputation for having the ‘nuttiest’ flavour when roasted, due to its higher oil content. They are typically grown in the states of Oklahoma and Texas and account for four percent of US production.

Valencia peanuts – having three or more kernels per shell – have a sweet flavour and are also used for all-natural peanut butter. They are also often boiled. Valencia peanuts are grown mainly in New Mexico and account for less than one percent of US production.

In total, seven states account for approximately 99% of all peanuts grown in the USA. Georgia (41%) grows the largest proportion of all peanuts, followed by Texas (24%), Alabama (10%), North Carolina (9%), Florida (6%), Virginia (5%) and Oklahoma (5%).

There are approximately 25,000 peanut farmers in the major producing regions. The peanut growing regions of the USA have direct access to the port facilities of the Atlantic Ocean and the Gulf of Mexico.

Significant exporters

According to *Soyatech*, world peanut production totals approximately 29M tonnes/year. Worldwide peanut exports are approximately 1.25M tonnes and the USA is one of the world’s leading peanut exporters, with average exports of between 200,000-250,000 tonnes/year. Argentina and China are other significant exporters.

Countries such as India, Vietnam and several African countries periodically enter the world market, depending on their crop quality and world market demand. Canada, Mexico and Europe account for over 80% of US exports. The largest US export markets within Europe are Germany, the Netherlands, Spain and the UK.

Demand for peanuts in North America and Europe has been steady, says *Soyatech*, although competition within a dynamic snack

The olive oil of Asia



An annual crop, the herbaceous groundnut or peanut plant, *Arachis hypogaea*, grows to between 30cm and 60cm in height, with bright yellow flowers close to the ground. Each peanut shell develops underground and contains between one and four seeds, with each seed comprising 50% of its weight in oil. The oil produced is naturally free from *trans* fats and cholesterol and is low in saturated fats. Like olive oil, it is high in unsaturated fats and it contains the heart friendly antioxidant vitamin E.

TABLE 1: PEANUT PRODUCERS (2008-09)

Country	Production (million tonnes)
China	14.30
India	6.25
USA	2.34
Nigeria	1.55
Indonesia	1.25
Myanmar	1.00
Sudan	0.85
Senegal	0.71
Argentina	0.58
Vietnam	0.80
World total	34.43

Source: USDA Foreign Agricultural Service

market continues to put pressure on peanuts to compete with a growing range of products, including crisps, extruded snacks, tree nuts and baked snacks. In addition, quality specifications, food safety concerns and import requirements continue to require the implementation of improved monitoring and quality control standards at origin.

Despite its potential as a biofuel feedstock, peanut oil is predominantly used as a cooking oil and is popular in a variety of cuisines around the world. The oil has an expectedly nutty taste, although it is odourless, and it has unique properties that make it perfect for frying food. Aside from its pleasant taste, it can withstand high temperatures, which means the oil can reach a temperature hot enough to make the outside of food crispy, while the inside remains soft. This high temperature tolerance also prevents the oil from seeping in to the food, as other oils do, making it a healthier option than most oils.

It is also notable that this process works both ways; the oil itself does not absorb the flavour of the food during the cooking process. This means that several different items can be cooked at once and each will retain its own distinct flavour, making it ideal for one-pot dishes such as stir-fry.

Refined groundnut oil, which is the most commonly sold and used by food manufacturers

and vendors, can even be enjoyed by people with peanut allergies, as the refining process removes the allergens.

Running on nuts

The first diesel engine was run on biodiesel derived from peanut oil. At the 1900 Paris Exposition Universelle, Rudolf Diesel debuted his eponymous engine, demonstrating how the method of converting ‘heat into work’ could be used to run farm equipment, ships and other vessels. By 1912, the efficient and reliable diesel engine was being used in ocean-faring ships.

Today, interest in peanut oil as a biodiesel persists, but the prohibitive cost of peanut oil makes it untenable as a biodiesel feedstock. The relatively low world output of peanuts and its constant global demand ensures that the price of peanut oil remains higher than other edible oils.

However, for personal use, there is an argument that the high average yield/acre of peanuts makes it a viable and cost-effective option for farmers looking to cut their own fuel costs.

Unlike peanuts farmed for edible use, peanuts farmed for fuel require less careful and specific farming techniques and more varied strains of plant, and can therefore provide yields of up to 123 gallons/acre of oil. Compared to an average of 50 gallons/acre of oil from soybeans, the oil of which is also used as a feedstock for biofuel and, due to the fact that peanut oil can be mixed in any combination with fossil fuel-based diesels, the peanut provides a high cost-saving potential for farmers looking to produce biodiesel for their own use.

According to *Farm Press Publications*, tests are underway at the University of Georgia, USA to develop non-edible peanuts that are high in oil and could be grown specifically for biodiesel production. These varieties are higher in oil content than currently grown runner and Virginia type varieties and would not compete on the world market with peanuts grown for food and commercial cooking oil products.

Georgia Brown is a commercially grown peanut that has a high oil content but is not good for commercial oil. ‘Georgianic’ is a test variety that is high in oil, low in input costs and not suitable for commercial use.

‘Georgianic’, or similar varieties, will likely be the future of peanut biodiesel, according to Daniel Geller, a research engineer at the University of Georgia.

Finally, the method used to produce biodiesel from peanuts is relatively simple. Crude oil is filtered and mixed with methanol and sodium hydroxide to create a methyl ester, or biodiesel.

The production of biofuel from peanuts is scalable to the needs of the farm, which tallies with Rudolf Diesel’s own vision for his engine, as announced at the Paris 1900 Exposition: “The diesel engine can be fed with vegetable oil and would help considerably in the development of agriculture of the countries that use it.”

Diesel’s foresight with regards to the future of the fuel industry was also apparent: “The use of vegetable oils for engine fuels may seem insignificant today. But such oils may become, in course of time, as important as petroleum and the coal tar products of the present time.” ●

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