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Fat of the land

The impact of the production and consumption of vegetable oils on people and the environment

Food Facts No 11

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Fat of the land

The impact of the production and consumption of vegetable oils on people and the environment

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Healthy oils?

Are fats and oils healthy? Most people have the notion that animal fats are considered "bad" and that vegetable oils are "good". However the picture is more complicated as vegetable oils vary and can be chemically changed when processed. What is true is that some types of oils and fats are essential as part of a healthy diet and yet excessive consumption may lead to health problems. To understand the health implications of eating vegetable oils, it is helpful to understand the structure and types of fat.

Facts and oils

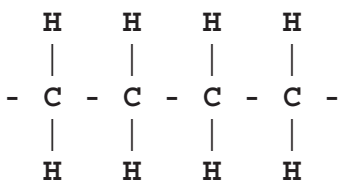
- Fats and oils have the same chemical structure
- Fats and oils are mixtures of triglycerides - fatty acids joined to a molecule of glycerol (see *Types of fats*)
- Fats which are liquid at room temperature are called oils
- Fats and oils are insoluble in water
- Fats and oils carry flavour, odour and fat soluble vitamins
- Margarine is 80-90% fat
- Butter is also an emulsion of water and fat (80%)
- Lard comes from pig's fat
- Suet is the fat around organs of many animals including sheep

Types of fat

All fats (animal and vegetable) are made up of fatty acids and glycerol. A fatty acid is made up of long chains of carbon atoms as shown in the diagrams. There are over 40 types of fats but these can be categorised into three broad groups:

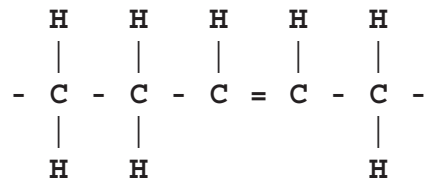
Saturated

These fatty acids are so named because each carbon atom is surrounded (or saturated) with hydrogen atoms. There is a strong correlation between saturated fatty acids and mortality from coronary heart disease. Saturates increase the total plasma cholesterol, making the blood 'sticky', and causing lumpy obstructions to form on the arterial wall (see *Fats and disease*). The main sources of saturated fats are dairy products, meat and processed foods. Trans fatty acids or hydrogenated fats (see *Hydrogenation* below) are similar to saturated fats as all the carbon atoms are also surrounded by hydrogen atoms (see diagram below).



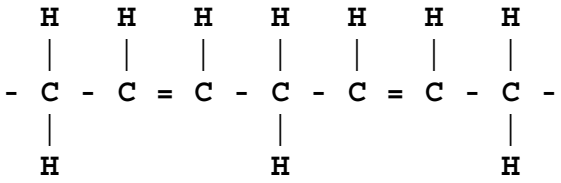
Unsaturated (Mono)

If some of the hydrogen atoms are missing, and have been replaced by a double bond between the carbon atoms, then the fatty acid is said to be unsaturated (see diagram below). If there is one double bond then the fatty acid is known as a monounsaturated fatty acid (or MUFA). Until recently, these fats were regarded as neutral in their effect on heart disease. However, it is now believed that monounsaturates are as good as polyunsaturates (see below) in helping to prevent the build up of cholesterol. Virgin olive oil has been promoted by the EU (see *Europe promotes olive oil* and *Greasy pricing*) for its health benefits as it is around 74% monounsaturates. However other vegetable oils also contain similar proportions of the three types of fats such as rapeseed oil, safflower oil and hazelnut oil (see the table *Fatty acids and vitamin E*).



Unsaturated (Poly)

If there is more than one double bond in an unsaturated fatty acid, then it is known as a polyunsaturated fatty acid (or PUFA). These fats, when eaten in moderation, can help prevent the build-up of obstructions and decrease total cholesterol. Polyunsaturates also provide the only two types of fats that are essential for human survival and cannot be created within the body. These are known as essential fatty acids (EFAs). The two EFAs without which humans would die are known as omega-3 (also called alpha linolenic acid or n-3) and omega-6 (also called linoleic acid or n-6) - see *Essential fatty acids* below.



The complete fat molecule is made up of three fatty acid carbon chains attached to a glycerol and therefore known as a triglyceride. Saturated (and hydrogenated) fats tend to be solid at room temperature while unsaturated fats tend to be liquid at room temperature (and are called oils). Unsaturated fats are also more prone to go rancid, as they are more easily oxidised when exposed to air. Manufacturers wanting to produce processed foods with long shelf-lives therefore tend to favour saturated or hydrogenated fats (see *Hydrogenation* below).

Fat as a nutrient

Fats perform many important functions in the human body: as a carrier of the fat-soluble vitamins A, D, E and K, and as a source of concentrated energy and EFAs. However the nutritive qualities of an oil can be removed when heated or processed.

Calories

Vegetable oils are similar to cooking fats (such as lard and hardened vegetable fat), butter and margarine in being rich in calories, i.e. having many calories per unit weight. Butter and margarine have some water content, but vegetable oils, lard and animal fats are virtually pure fat. Fat contains 9 calories (37 kilojoules) per gram, compared with the other primary sources of calories (protein, starch, sugar) which all contain less than four calories per gram. Thus foods rich in fat tend to be high in calories per portion.[2]

Essential fatty acids

The two main EFAs important for human health are omega-3 and omega-6. Both need to be present in the diet and the body is unable to convert one type into the other. Whilst the amount of omega-6 eaten in Europe has risen, the amount of omega-3 consumed has fallen. Ideally the maximum ratio of omega-6 to omega-3 consumed is 5:1. In the UK, the ratio is nearer to 8:1 and in the US and Australia

Fats and calories[3]		
	% fat	**Calories per tablespoon (15g)**
Nuts	45-70, typically 55	typically 75
Seeds	45-60, typically 50	typically 70
Vegetable oils	95-99	130
Lard	99	130
Vegetable cooking fat	99	130
Butter	80	110
Margarine	80	110
Reduced and low fat spreads	40-70	50-95
Very low fat spreads	20-40	30-50

the ratio is nearer 12:1 and this imbalance has been identified as a possible cause of modern health problems.[4] It is generally accepted that richer nations tend to consume enough omega-6 fatty acids, but are deficient in omega-3 so should address this imbalance by eating more omega-3 fatty acids.

The omega-3 family of polyunsaturated fatty acids can be further divided into two groups: short chains (alpha linolenic acid or ALA) and long chains (eicosapentaenoic acid - EPA and docosahexaenoic acid - DHA). The short chains are mainly found in plants (including some of the vegetable oils listed in the table *Fatty acids and vitamin E*) whereas the long chains are found almost uniquely in sea food. The human body can only utilise the long chains though short chains can be converted into long chains. There are concerns that this conversion process may be inefficient and so non-fish eaters may need to increase their consumption of EFAs.

Omega-3 has been shown to play an essential role in the human unborn and newborn brain and retinal development, and provide protection against heart disease, stroke and certain cancers. It has also been claimed that omega-3 can help in preventing arthritis, asthma, autoimmune diseases, Crohn's disease, inflammatory skin diseases, depression and schizophrenia.[5] The recommendation is to eat about 100g (3oz) oily fish per person per week. Oily fish include tuna, salmon, sardines, herring, mackerel and pilchard.

The vegetable oils which have a high omega-3 level (see the table *Fatty acids and vitamin E*) include flax or linseed oil (53%) and walnut oil (14%). Of the more common oils, both soybean oil (7%) and rapeseed oil (9%) contain significant amounts of omega-3. Olive oil (1%) in contrast has very low levels of omega-3 despite the numerous health claims made about the oil (see the box *Scientists cannot agree*).

Vitamin E

Besides fats and oils, many vegetable oils contain vitamin E. This is a valuable vitamin to consume as it acts as a natural antioxidant in the body, neutralising loose oxygen compounds that can cause cell damage including, it is thought, triggering changes in cells that lead to heart disease and cancers. It is the main chemical that we eat that is able to deal with oxygen in the fatty tissue of our cells. A government report suggested that 3-4 mg of vitamin E per day would be adequate for most people.[7] Extracting the oil from its original source may reduce the vitamin E content, as may purifying and heating the oil.

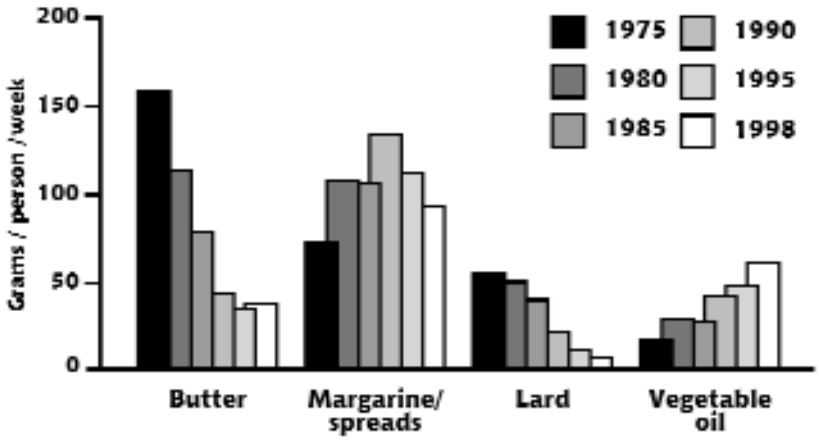
Cooking with oils

The ideal temperature to fry food in oil is between 180°C and 200°C at which point the surface of the food seals almost instantly, minimising oil absorption. To test whether oil is at the correct temperature for cooking, perform this simple test: drop a cube of bread into the oil and it should brown in 60 seconds.[8] Oils reach smoking points (the point at which the oil begins to decompose and smoke) at different temperatures, and for frying it is advisable to use oils and fats that can sustain high temperatures before reaching this smoking point (see *Hot oils)*. The decomposition of the oils leads to deterioration of flavour and the accumulation of traces of compounds which have been shown to be toxic to laboratory animals.[9] Oils that have already been heated to smoking point should not be re-used. For this reason olive oil, which easily reaches smoking temperatures, is not recommended for sustained high-temperature frying, whereas corn or rapeseed oil are

Hot oils

	Smoke temperature[10]
Olive oil	175 °C
Butter	208 °C
Lard	215 °C
Hydrogenated vegetable fat	220 °C
Canola (rapeseed) oil	224 °C
Cottonseed oil	225 °C
Corn oil	225 °C

Shoppers purchases of fats and oils[21]



Above the recommendations [19]

% of calories from fat	total fat	saturated fat
UK COMA recommendations	33%	10%
Current UK male average	37.6%	15.4%
One in 40 men	over 47.1%	over 21.7%
Current UK female average	39.2%	16.5%
One in 40 women	over 48.6%	over 22.9%

Fat consumption in the UK [18]

grams per day	men	Women	infants age under 5
Government recommendations[18a]	95	70	not specified[18b]
total fat	102	74	46
of which saturated fats	42	31	21
hydrogenated fats	6	4	2
monounsaturated fats	31	22	14
polyunsaturated fats	20	14	9
of which omega-3	2	1	1
omega-6	14	10	5
Not everyone is average - one in forty consumers have intakes like these:			
total fat	156	125	75
total saturates	69	55	35

degenerative disorders associated with a diet that contains excessively high fat are established during childhood and adolescence.[17]

Western trends

In the higher-income countries fat consumption as a proportion of total energy is slowly decreasing. This is mainly as a result of healthy dietary advice to reduce fat consumption. In the UK there has been a trend to move away from butter as a source of fat towards vegetable oils as shown in the graph *UK supplies of butter and vegetable oils.* Butter contains 62% saturated fat compared to sunflower oil with only 10% saturated fat. This has helped to reduce the consumption of saturated fatty acids. Similarly, lard (39% saturated fat) has been virtually removed from the diet as shown in the graph *Shoppers purchases of fats and oils.* The graph *Consumption of margarines* shows that the use of 'low-fat' spreads has been rising fast, now accounting for nearly three-quarters of all spreads and margarines (for more details about margarine see *Margarine - 80-90% fat*).

Consuming oils around the world

The quantity and quality of fat consumed varies greatly in different parts of the world and generally consumption of total and saturated fat increases with economic development. The main reason for this difference is the types of food eaten in high-income countries which includes higher quantities of meat, dairy, and baked goods which contain hydrogenated fats and oils. In low and middle income countries fat supplies less than 15-22% of total energy whereas in northern Europe and North America fat supplies between 30-45% of total energy.

The Food and Agriculture Organisation of the United Nations provides interesting figures that demonstrate a global north-south divide exists in the consumption of vegetable oils. All the high-income countries consume more vegetable oils per person than average, whereas the poorer countries all consume less. The US and Canada consume two and half times more oils per person, and subsequent calories and fat, than Africa (see *Consuming fats - a worldwide perspective*). Many of the 'developing countries' are also more dependent on vegetable oils with higher saturated fats such as palm oil (see *Healthy oils?*). For example, sub-Saharan Africa consumes 3.29 kg of palm oil per person per year as compared to Europe where only 0.59 kg per person per year is consumed. China is unusual in that, on average,

Scientists cannot agree

Scientists agree that eating too much fat is bad for your health. However, they seem unable to agree on which type of fatty acid is more, or less, healthy. Much of the nutritional research into fatty acids is funded by bodies with vested interests in either those oils high in monounsaturates (such as olive oil - see *Europe promotes olive oil*) and those oils high in polyunsaturates (such as sunflower). There is even research undertaken to show the benefits of using a vegetable oil high in saturated fats, as shown in the promotional material provided by the Malaysian Palm Oil Promotion Council.[23]

Different research studies arrive at conflicting conclusions (e.g. [24 25 26]) and many of these studies have been used as 'evidence' of the health benefits of the various oils. The olive oil industry in particular has been guilty of much hype about the benefits of olive oil, when in fact the evidence is either speculative, inconclusive or incorrect.(e.g.[27 28 29]) In reality it is very difficult to say that either unsaturated or polyunsaturated oils are better for your health. What is clear, however, is that all unsaturated fatty acids are probably more healthy than saturated fatty acids. But the most compelling evidence for good health is that those who eat most fresh fruits and vegetables, whole grains and beans regularly live longer and are at reduced risk from developing heart attacks and certain cancers.

Greasy pricing?

The table *Shopping at Tesco's* shows a typical range of prices for a litre of vegetable oil which can be found in any shop or supermarket in the UK. Sunflower oil, a popular vegetable oil throughout Europe, is used as a comparison. The only oil which is cheaper than sunflower oil is the vegetable oil. Most of the other oils are of a comparable price, with the exception of the olive, sesame and walnut oils.

Olive oil

One reason that people still buy olive oil, despite the high price, may be the widely publicised health benefits (see *Scientists cannot agree*). The European Olive Oil Medical Information Library (see *Europe promotes olive oil*) does show that a Mediterranean diet will reduce the risk of several illnesses, when compared to a northern European or US diet. What has not been proved is the role that olive oil in particular plays in the healthy Mediterranean diet, which is also rich in fruit, vegetables, and starchy foods such as pasta, rice and bread. If olive oil were to be replaced with another oil, such as safflower oil or soybean oil, the same health benefits may still be experienced. The table *Comparison of olive, soybean and rapeseed oils* shows that other oils do have similar or improved nutritional properties. Indeed, in this

Comparison of olive, soybean and rapeseed oils[32]

	Saturated (%)	mono-unsaturated (%)	poly-unsaturated (%)	omega 3 (%)	omega 6 (%)	Vitamin E (mg per 100g fat)
Olive oil	14	74	8	1	8	12
Soybean oil	14	23	58	7	51	51
Rapeseed oil	7	59	30	9	20	21

Shopping at Tesco's

Type of oil (Tesco's own brand unless otherwise stated in brackets)	Price per litre	Price compared to Sunflower oil (+ or - %)
Vegetable oil	£ 0.53	-21%
Sunflower oil	£ 0.67	0%
"Soyola" Pure Soya Oil	£ 0.85	+27%
Maize (corn) oil	£ 0.89	+33%
"Golden Fields" Pure Rapeseed Oil	£ 0.99	+48%
Groundnut oil	£ 1.79	+167%
Grapeseed oil (sold as 500ml only)	£ 1.90	+184%
Olive oil	£ 3.69	+451%
Extra Virgin oil	£ 4.29	+540%
Mild and Light Olive oil (sold as 500ml only)	£ 4.50	+572%
Finest Stir Fry oil (sold as 250ml only)	£ 5.96	+790%
Sesame oil (sold as 250ml only)	£ 7.16	+969%
Finest Walnut oil (sold only as 250ml)	£ 7.96	+1,088%
Finest Tuscan Extra Virgin oil (sold as 250ml only)	£ 11.96	+1,685%

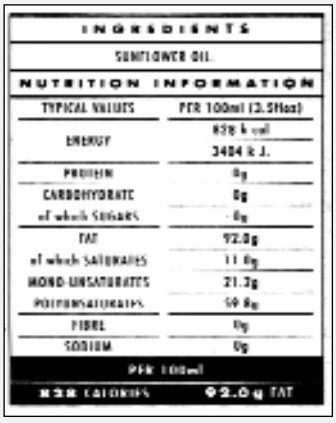
Which is healthier?

Three oils bought at Sainsbury's are presented here to show the main differences in fatty acid content and price.

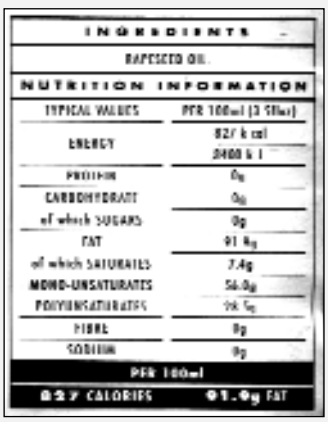
Olive oil £4.59 per litre

NUTRITION INFORMATION	
TYPICAL VALUES	per 100ml
ENERGY	3382 k J. 823 k cal
PROTEIN	less than 0.1g
CARBOHYDRATE	0.0g
of which sugars	0.0g
of which starch	0.0g
FAT	91.4g
of which saturates	13.1g
of which mono-unsaturates	66.7g
of which polyunsaturates	7.5g
FIBRE	0.0g
SODIUM	less than 0.1g
per 15ml TABLESPOON	
123 CALORIES	13.7g FAT

Sunflower oil £0.79 per litre



Rapeseed oil £0.75 per litre



example olive oil has the lowest levels of both the antioxidant vitamin E and the essential omega-3 fatty acids. Olive oils are also not very suitable for cooking as they have one of the lowest decomposition temperatures amongst vegetable oils (see *Cooking with oils*). Considering the price of olive oil (see *Shopping at Tesco's*), the amount of money spent on promoting olive oil and protecting European olive oil farmers (see the section *Subsidised oils*), and the environmental damage caused by growing olives (see the section *Olive oil*), it would appear that the benefits of olive oil have been much exaggerated.

Europe promotes olive oil

The European Union is eager to promote the use of olive oil by emphasising the health benefits of olive oil consumption. The EU has set up a European Olive Oil Medical Information Library the purpose of which is to: *"...share scientific and medical information on the role of diet in general and olive oil in particular"*.[33]

All the information has been researched and validated by Dr. Gerd Assmann and Dr. Ursel Wahrburg from the Institute of Atherosclerosis Research, University of Munster, Germany. The purpose of the research is to show that olive oil has played an important role in the traditional healthy Mediterranean diet. Olive oil is high in mono-unsaturated fatty acids which, it is claimed, help to reduce diabetes, obesity and coronary heart disease. Tentative claims have also been made for the possible anti-cancer properties of olive oil.

Growing oil

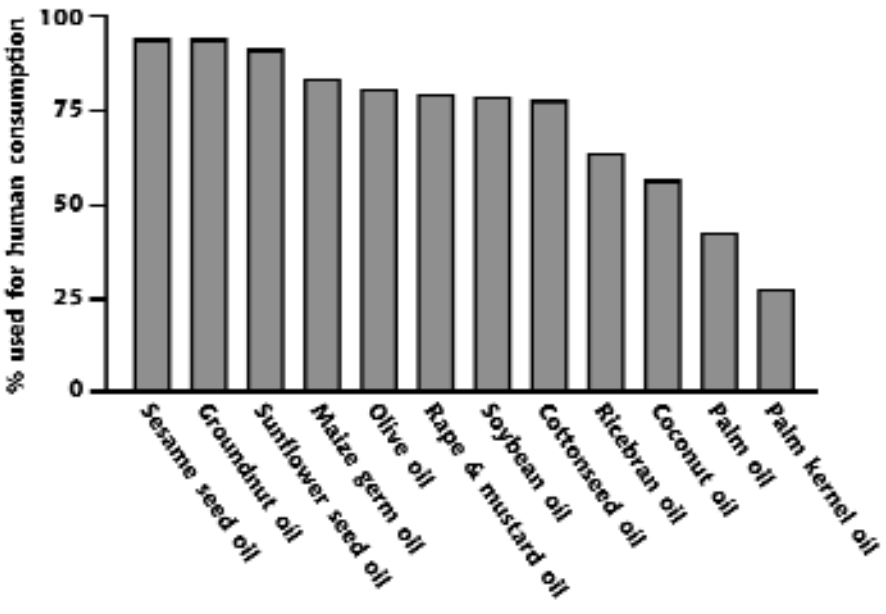
There are three major groups of oil crops:

- Annual or biennial crops such as soybean, sunflower and rapeseed
- Perennial crops such as oil palms and coconut
- Those crops where the oily embryo is a by product, such as from cotton and maize

Most of the world's vegetable oil comes from soya beans, accounting for a quarter of all the vegetable oil consumed in the world. Increased production of palm oil in the last couple of decades has ensured that it is the second most popular vegetable oil, and third place is taken by oilseed rape which is the only vegetable oil crop grown in the cooler temperate areas. Sunflower is the fourth largest source of vegetable oil and together these four oils account for nearly three-quarters of all vegetable oils consumed in the world. Groundnut oil is an important crop for many poorer countries, grown and traded at a local level and an essential part of local economies.

NOTE: All data in this section is from the United Nations Food and Agriculture Organisation agricultural database[34] unless otherwise stated.

Percentage of each oil used for human consumption in 1997



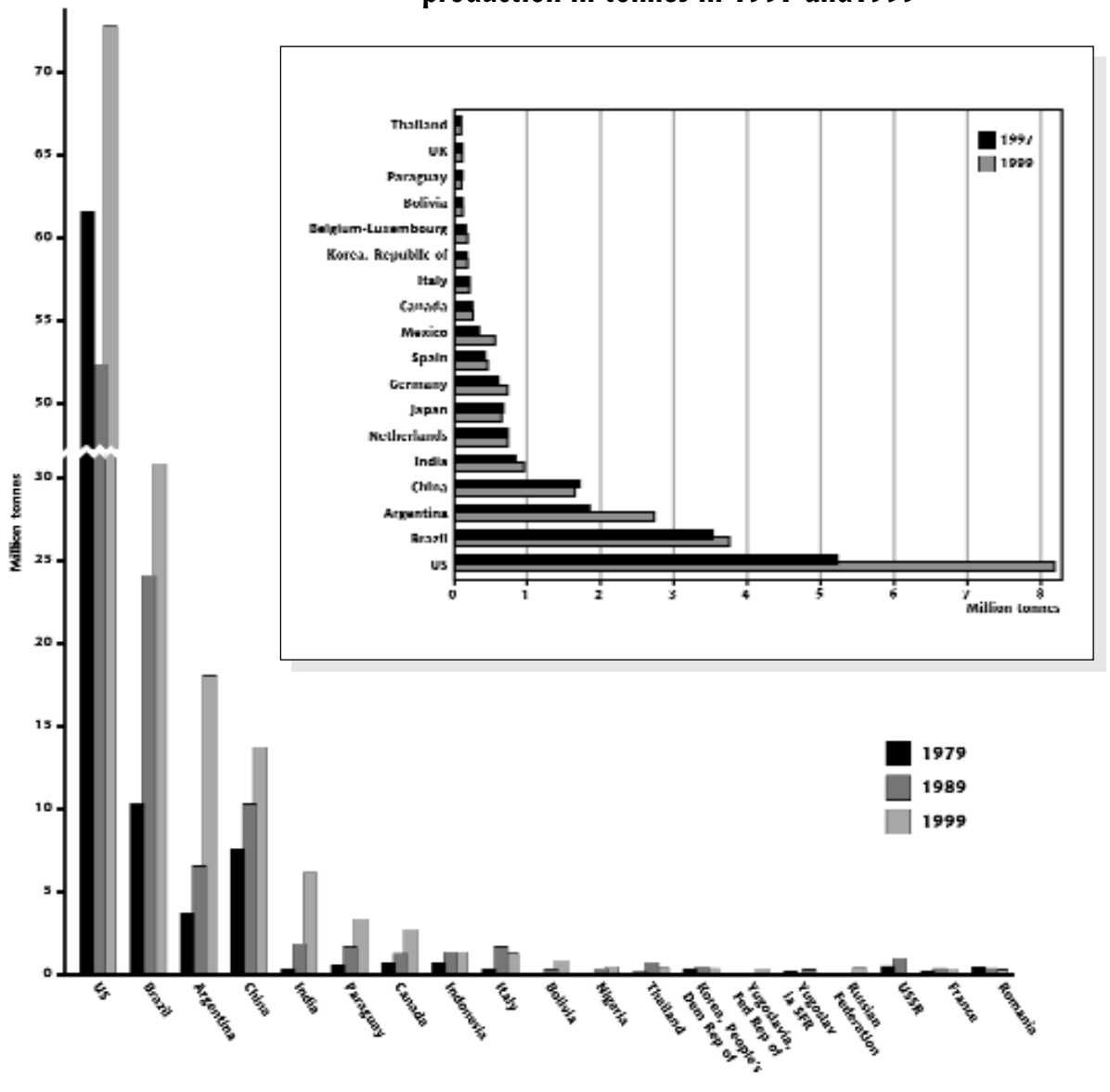
Soybean oil

Soybean *(Glycine max)* is grown throughout the world and is an important edible crop for both humans and livestock. In 1999 the largest producer in the world was the United States producing 47% of all soybeans and 36% of all soybean oil. Brazil and Argentina together produce nearly a third of all soybeans and over a quarter of the world's supply of soybean oil (see the graphs *Soya bean production* and *Soybean oil production*).

Environmental concerns about soya bean production range from deforestation, loss of small farms, and pesticide use, to the new concerns about the impact of genetically modified soya on biodiversity and pesticide use. More details about soybean production and its impact on the environment can be found in Food Facts Number 5, *Soya: The ubiquitous bean.*[35]

Most of the soybean oil in the world is consumed in margarine, salad oils and shortening. Soybean is considered to have a poor flavour and is one of the main reasons it is usually mixed with other ingredients.

Soya bean production in tonnes (1979-1989-1999) and (insert) soybean oil production in tonnes in 1997 and1999



GM oilseed rape in the UK

The genetic modification of oilseed rape has become very common recently with 62% of Canadian oilseed rape (OSR) being genetically modified (GM).[43] At the time of writing GM OSR was not being commercially grown in the UK and, following a voluntary moratorium between the government and industry, is unlikely to appear before 2003. However, both industry and the government are performing a number of trials as shown in *Testing the GM rape*.

The GM OSR in the UK, developed by AgrEvo's subsidiary Plant Genetic Systems, has been modified to be tolerant to the glufosinate herbicide. However a number of potential problems have been identified with GM OSR including the transfer of modified gene(s) into other plants, both wild and cultivated. This problem is particularly acute with OSR as the crop has so many wild related species. The most likely species to cross with OSR are: *Brassica nupus* (feral oilseed rape), *Brassica rapa* (wild turnip / field mustard), *Brassica nigra* (black mustard), *Hirschfeldia incana* (hoary mustard), *Raphinius sativus* (garden radish), and *Brassica juncea* (mustard greens). The DETR experiments (see *Testing the GM rape*) have shown that gene transfer has already occured moving from GM OSR into non-GM OSR and turnip rape. Equally worrying in the DETR trials has been the emergence of GM OSR volunteers. Volunteers are weeds of the same species as the original crop (in this case oilseed rape) which emerge in crops grown in the following years. The farming industry has already admitted that OSR herbicide resistant volunteers will be an inevitable consequence of GM OSR (see quote). Such plants would be more difficult to remove with broad-spectrum herbicides. Current official recommendations for the separation distances between GM and non-GM crops is 200 metres, but evidence suggests that actual OSR pollen movement when fertilisation of same species has been recorded is 4 km.[45 46]

"Herbicide-tolerant rape will undoubtedly become part of established volunteer weed populations that occur in many cereal rotations" [49]

Testing the GM rape

The Department of the Environment, Transport and the Regions (DETR) has funded a three year project looking at the agronomic and environmental impact of GM crops, including a farmscale biodiversity evaluation study. The Ministry of Agriculture, Fisheries and Food (MAFF) is funding a study into the agronomic impact of herbicide tolerant OSR. The National Institute of Agricultural Botany (NIAB) is co-ordinating a four year study into the interactions between herbicide tolerant and conventional crops grown in rotations. NIAB is also leading a five year European Science Foundation Research Programme to harmonise testing and research of GM crops.[44]

"Commercial production of [GM] *OSR* [Oil Seed Rape] *is some way off...it is not a priority"* [47]

Nigel Padbury, Novartis Seeds, 1999

Rapeseed in the UK

	1996	1997	1998
Hectares (thousands)	356.4	445.2	506.0
Yield (tonnes / hectare)	3.5	3.2	3.0
Production (thousands of tonnes)	1246.0	1444.0	1518.0
Area of winter rape	302.4	375.9	443.1
Area of spring rape	53.8	68.8	62.2

Consumption

Rapeseed is processed primarily for its oil. Rapeseed oil, often known as canola oil, is used for salad oils, shortenings, frying oils and margarines. Rapeseed oil is often used as a salad oil as it does not cloud when refrigerated and has a bland taste. Rapeseed is not perfect for frying though. Frying oils need to have a high temperature smoke point (224^{0}C - see the section Cooking with oils), light colour, bland taste and little odour. Unfortunately rapeseed can produce an unpleasant smell from the linolenic acid oils and for this reason, has not always been popular in Europe. Moreover, for margarines rapeseed oil must always be mixed with other vegetable oils to prevent crystallisation.

Shooting over rape

In February 2000, a mass shooting of wood pigeons (and other birds) took place in the UK, organised by the National Gamekeepers Organisation. Wood pigeons have been targeted as they are accused of damaging oilseed rape crops during the winter months. The National Farmers Union claimed in 1992 that wood pigeons did £4 million worth of damage, though this would seem to be a small cost when compared with the high levels of subsidies received (see the section *Subsidised oils*). Many people concluded that the shoot would do little to reduce wood pigeon numbers and was merely *"a day for game-keepers to be united in a rather spurious cause".* [41]

Oil spill

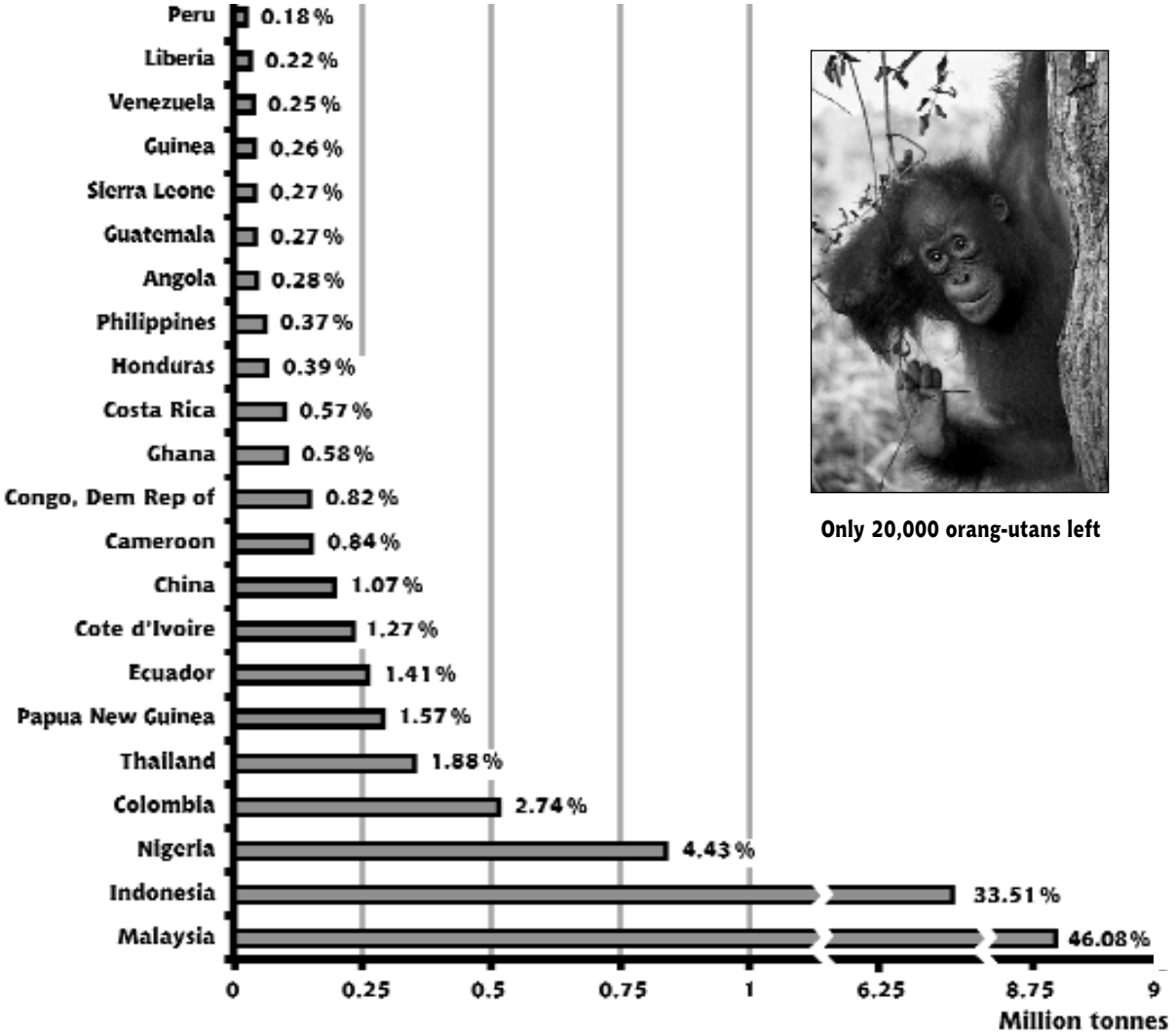
In 1989 an oil spill caused environmental havoc in Vancouver Harbour, Canada. But this wasn't the usual oil tanker; the oil was rapeseed not petroleum and more than 700 birds died. It has been estimated that the effects of vegetable oil spills are far worse than petroleum oil spills.[42]

100% rapeseed oil

More and more oil palm

Area (ha)	1966	1977	1987	1997	1999
Columbia	5,600	17,400	51,560	137,677	129,000
Indonesia	85,000	140,000	421,600	1,622,503	1,795,081
Malayasia	78,500	521,486	1,373,147	2,317,000	2,317,000
Nigeria	2,100,000	2,150,000	2,230,000	3,100,000	3,220,000
Yield (kg ha $^{-1}$)					
Columbia	151.8	151.6	166.6	181.6	209.3
Indonesia	109.8	171.4	210.1	165.2	149.3
Malayasia	143.8	143.8	166.0	199.8	183.9
Nigeria	57.9	122.1	105.3	145.5	142.9

Palm oil production 1999 (tonnes)



Only 20,000 orang-utans left

Olive oil

Production

The olive tree (*Olea europea*) is a perennial evergreen tree which grows best in temperate areas with warm dry summers. The fruit are used as both a source of oil and eaten raw, though the vast majority (over 80%) is for the production of oil. Olive oil dominates the economy of the Mediterranean countries with Italy, Spain, Greece and Tunisia producing 86% of the world's olive oil. Indeed countries adjacent to the Mediterranean Sea produce over 98% of the world's supply of olive oil. Olive groves are one of the oldest and most important agricultural systems around the Mediterranean and play an important role in the local culture, landscape and economy. Intensity of production can vary greatly between regions and countries, from 17 trees per hectare in southern Tunisia to over 1,000 trees per hectare in Italy.

Olives in Spain

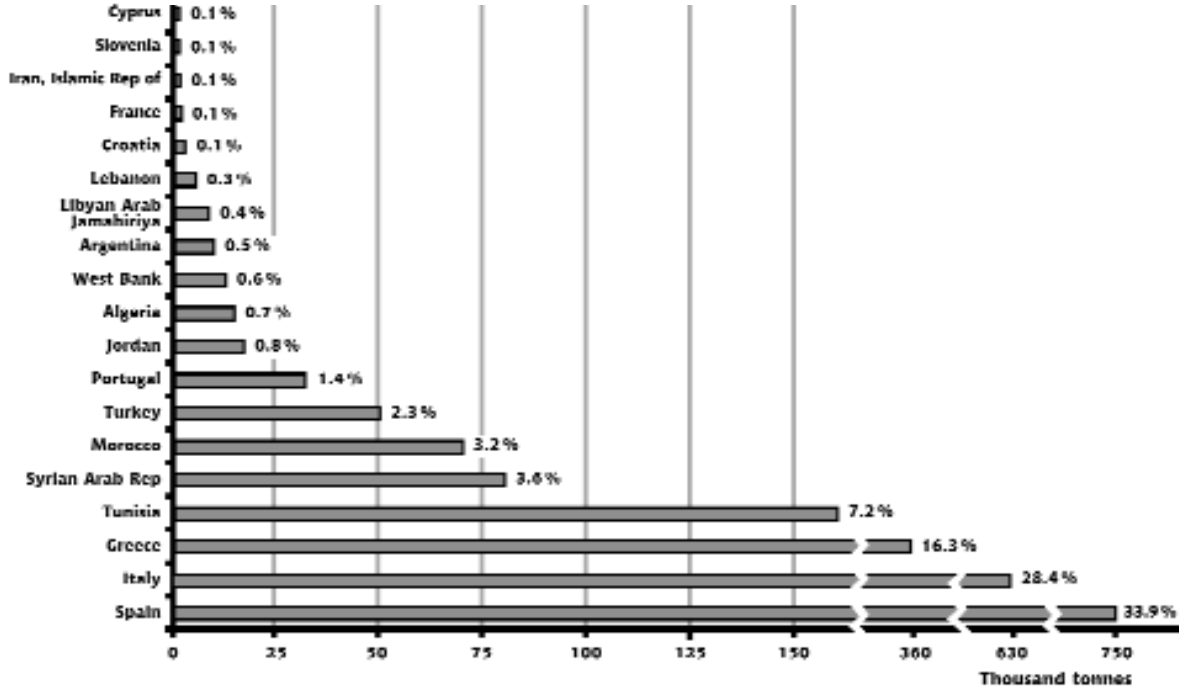
Olive cultivation in Spain has usually been based on a traditional, low input system. Some 95% of all olives are grown without irrigation, and manual labour is normally used for olive collection. Co-operatives are very important for many olive growers who are often small scale or part time farmers. All the olives from one area are taken to the co-operative which then presses all the olives together for oil. Farmers are given a volume of oil proportional to the quantity of olives they contributed.[52]

Many of the agronomic and environmental problems associated with olive production have emerged from new systems dedicated to maximising production. Olive production in Spain is concentrated mainly in the Andalucia region, with about 2 million

Olive varieties in Spain

Variety	Area cultivated - hectares[54]
Picual	600,000
Cornicabra	300,000
Horjiblanca	220,000
Lechín	200,000

Production of olive oil in 1999 (tonnes)



Subsidised oils). But just as traditional olive groves are replaced by more intensive systems, action is also being taken to increase production of organic olive oil:

Crete, Greece

Many of the olive groves in Crete, Greece, use intensive techniques which has led to severe soil erosion and reduced biodiversity. A new project has been set up in Crete by the Cretan Agri-environmental Group (CAG) which encourages farmers to use ecosystem-based farming methods. The farmers use the International Federation of Organic Agricultural Movement (IFOAM) standards as a marketing label and it is hoped that similar projects may be established in other countries. CAG has found that, to ensure that the systems work well, the olive groves often need to be re-designed For more information contact CAG (see Contacts) or view the reference.[60]

Valencia, Spain

One town in the Valencia region is undergoing economic recovery by converting existing groves to the production of organic olive oil. Today, near the town of Millares, 85% of the farmers are organic olive oil producers. Approximately 900 hectares of olives are cultivated by 352 farmers. In 1999 7,000 litres of olive oil were collected, and it is hoped production will increase to 30,000 litres in 2000. The olives are produced using strict organic methods and the farmers are all certified organic.[61]

Consumption

Olive oil has been graded according to the quality and techniques used in processing. Virgin and Extra Virgin are not mixed with other oils (including olive oils) and the oil is extracted through mechanically pressing the olives. Refined olive oil has been neutralised, bleached and deodorised. Refined oils are often mixed with Virgin oil to produce Pure olive oil. All olive oil needs to be extracted from the fruit within three days of harvest. Olive oil is mainly eaten in the countries which produce the oil and throughout the European Union (see *World consumption of olive oil*). Both the US and Japan are growing exceptions to this, as olive oil is marketed on its health benefits in these countries.

The difference between the olive oils [Extra Virgin, Virgin, or plain olive oil] *is their acidity level, which affects taste, not nutritional content. Oils have varying amounts of anti-oxidants, but that is not reflected in their classification*

Dr J Deane, Olive Oil Source[30]

World consumption of olive oil (1998/9)[62]

Country	% of total olive oil	Tonnes
European Union	70.5%	1,690,000
United States of America	6.0%	147,500
Syria	4.0%	98,000
Turkey	2.5%	60,000
Morocco	2.5%	55,000
Algeria	1.0%	20,000
Other	9.5%	234,500

Minor oils

A number of oils have relatively small production levels. Many of these oils are important for the local economies in poor countries, and play little role in the global trading of vegetable oils. As research and development institutions try to expand the number of vegetable oils exploited It is likely that many of these oils will play a more prominent role on world markets in the future. There are also many plants which are capable of producing vegetable oils as shown in *Potential oils.*

Maize: *Zea mays* - most of the maize (corn) oil is produced in the US. Production of corn oil is now at similar levels to that of olive oil.

Safflower: *Carthamus tinctorius* - considered to be a premium cooking oil and production has expanded in the 20th century.

Sesame: *Sesamum indicum* - India, China, Sudan, Japan and Burma are the major producers. This oil is mainly used for cooking.

Rice bran: *Oryza sativa* - mainly grown in Asiatic countries.

Poppy: *Papaver somniferum* - mostly grown for opium, but a potentially good source of oil.

Hemp: *Cannabis sativa* - edible oils have been mostly produced in Asia.

Potential oils

The following plants are potential sources for commercial oil production, all in topical areas:

- Winged bean
- Lupine
- Oil bean
- Carambe
- Jojoba
- Babassu
- Almond

Not such a minor oil - corn oil is one of the fastest growing oils in the world

Subsidised oils

Many of the oils produced around the world are subsidised by governments to protect the farmers from low and fluctuating world market prices. The two examples given here will focus on Europe.

The EU oilseeds policy

The oilseeds support regime, agreed in October 1991 and which was slightly altered in the 1992 Common Agricultural Policy (CAP) reforms, was designed to stabilise production and reduce budgetary expenditure. This was a switch from supporting the oilseed processors to providing area payments for farmers. In October 1992, the General Agreement on Tariffs and Trade (GATT) and the Blair House EU - US bilateral negotiations forced the EU to introduce further specific set-aside land for the oilseeds sector. As part of the 1992 reforms the oilseeds sector became part of the Arable Area Payment Scheme which also incorporated cereals and protein crops. The EU Oilseeds Policy provides area payments for rapeseed, sunflower seed and soybeans. The intention of the policy was to maintain farm incomes above what would be provided by world market price. The payments (known as the *Reference Price System*) are calculated from the difference between the guaranteed price level and the estimated world price multiplied by the average yield and area grown.

Under the Blair House agreement, which paved the way for the 1994 GATT US - EU oilseed agreement, a Maximum Guaranteed Area (MGA) has been set at 5,482 hectares for the 15 countries of the EU (minus set-aside area). Each country is allocated an area for oilseed crops and excess planting is penalised through a reduction in oilseed payments. For example between 1997 and 1998 payments per hectare in England were reduced by 22% from £377.90 per hectare to £297.[63]

Since 1996 the US has been increasing its production of vegetable oil, particularly soybean oil (see *Soybean oil*). It was in 1996 that the US Farm Bill was passed which liberalised the markets for many agricultural commodities. This increase in production is likely to further reduce vegetable oil prices worldwide and thereby increase the EU cost of supporting oilseed producers.

Arable area payments in general have been declining in Europe, and support for oilseed rape in particular has been reduced.[65] However, despite this, and the Blair House agreement, production of oilseeds in Europe has increased from 12 million tonnes in 1992 to 15.6 million tonnes in 1998 and 16 million tonnes in 1999. This can be compared to only 1.5 million tonnes produced in 1970.[64]

In 1999 the Agenda 2000 CAP reforms agreed to cut the arable area payments for oilseeds to the same amount as other arable crops as from 2002-03 (63 Euros per tonne). These cuts will be gradually increased between 2000 and 2002. This has meant a considerable cut in support for oilseeds compared to previous levels, though due to overproduction in the UK, the effective reductions in payments will not be substantial. As oilseed rape is also important as part of an arable rotation many believe it is unlikely that there will be large reductions in the area planted. In contrast, others believe that the area of oilseed rape will be reduced by up to 20% and linseed is likely to disappear from the UK landscape.

EU self sufficiency

Sunflower, rapeseed and olive oils are the main vegetable oils produced in Europe. However Europe is not always self-sufficient in these commodities and sometimes needs to import vegetable oils to meet the increasing consumption of vegetable oils. Europe is self-sufficient in olive oil production(121.8%) and oilseed rape (122%), but is not with sunflower oil (38%). Soya production in the EU is very low, but has been steadily rising and Europe now is 19% self-sufficient in soybean oil, with soya grown on half a million hectares (mainly in Italy).[66]

The EU olive oil support regime

The EU is the largest producer of olive oil in the world (see *Olive oil*) and since 1966 has had a changing and complex set of regulations on the production of olive oil. This regime provided a system of prices for olive oil, export refunds, production aid, consumption aid, storage aid, and refunds for the canning industry (see the table *The changing face of the olive oil support regime*). The system of prices is divided into the target price (for production), the intervention price (set by the Council of Ministers), and the representative market price (price at which olive oil could be sold).

In 1998 new legislation has changed the original 1966 regime as the start of transitional reform arrangements. The European Commission itself has confirmed that "*there is a need for far-reaching reform of the olive oil sector support regime*".[67] One of the biggest changes is to increase the Maximum Guaranteed Quantity (MGQ), a similar scheme to the oilseed MGA (see above), by 31.6% to 1,777,261 tonnes in the EU. Each country will be allocated a national guaranteed quantity (NGQ) to limit overproduction by producers. Excess production is penalised through lower payments per tonne as shown in the table NGQ and actual production of olive oil.[68]

In 1997 the total amount spent on olive oil by the European Commission was nearly 2.2 billion Euros, equivalent to 5.4% of the total Common Agricultural Policy budget. This amount can be compared with amount spent on agri-environment schemes throughout the EU which accounted for only 1.66 billion Euros in 1997. From the 2.2 billion Euros, 17.7 million Euros was spent on "promotion measures" directly from the European Commission itself (see *Europe promotes olive oil*). Total expenditure on promoting olive oil between 1979 and 1997 was 130 billion Euros.[69] More money has been spent on promoting olive oil than any other single food as shown in the table *EC promotion budget*. In 1997 three quarters of the direct payments budget and a third of the entire promotions budget was used for publicising the

EC promotion budget

1997 - payments made by the European Commission either directly or through its member states as 'promotional expenditure'	**Expenditure in millions of Euros**
Total promotional expenditure	**54.2**
Olive oil	17.7
Apples and citrus fruit	8.0
Milk and milk products	7.3
Beef and veal	7.2
Grape juice	6.3
Quality	3.9
Live plants and floricultural products	2.1
Fibre flax	1.0
Nuts	0.7

NGQ and actual production of olive oil

Country	**NGQ (tonnes)**[71]	**Production in 1998/99 (tonnes) - includes oil from table olives in Spain, Greece and Portugal** [72]	**Subsequent payments (Euros / tonne)**[73]
Spain	760,027	890,700	1,011.5
Italy	543,164	428,800	1,173.6
Greece	419,529	512,000	875.0
Portugal	51,244	33,300	1,173.6
France	3,297	2,400	1,173.6

benefits of olive oil.[70] However the 1998 reforms have abolished Consumption Aid (see *The changing face of the olive oil support regime*) and it is likely that there will be no more European funds to promote olive oil.

Unfortunately the EU olive oil support regime has tended to support the further intensification of olive production. Subsidies have been paid for production of olive oil in an attempt to maximise productivity (see *Olive oil*).[66a] Reforms to the EU olive oil support regime are needed which would provide area-based payments, thereby reducing the pressure on growers to intensify and increase production.

The EU olive oil support regime has ensured that the price of olive oil has become more accessible throughout Europe

The changing face of the olive oil support regime

The original olive oil support regime 1966 - 1998	The transitional reform arrangements 1998 - 2001
MGQ set at around 1,350,502 tonnes	MGQ raised by 31.6% to 1,777,261
Prices for olive oil: target price, intervention price, and the representative market price	Intervention buying abolished - replaced by private storage system (see below)
Export refunds	Export refunds reduced
Production aid (higher payments for smallholders)	Production aid abolished for groves planted after 1st May 1998. Differentiation between small and large olive grove holders abolished
Consumption aid	Consumption aid abolished
Storage intervention	Payments for private storage will replace intervention buying as a system of intervention support
Monitoring - olive tree register	Olive tree register to be replaced by geographical information system (GIS) as used with arable crops

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The alliance for better food and farming

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To represent over 100 national public interest organisations working at international, national, regional and local level.

Our Aim

To advocate food and agriculture policies and practices that enhance the health and welfare of people and animals, improve the working and living environment, promote equity and enrich society and culture.

Please note

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