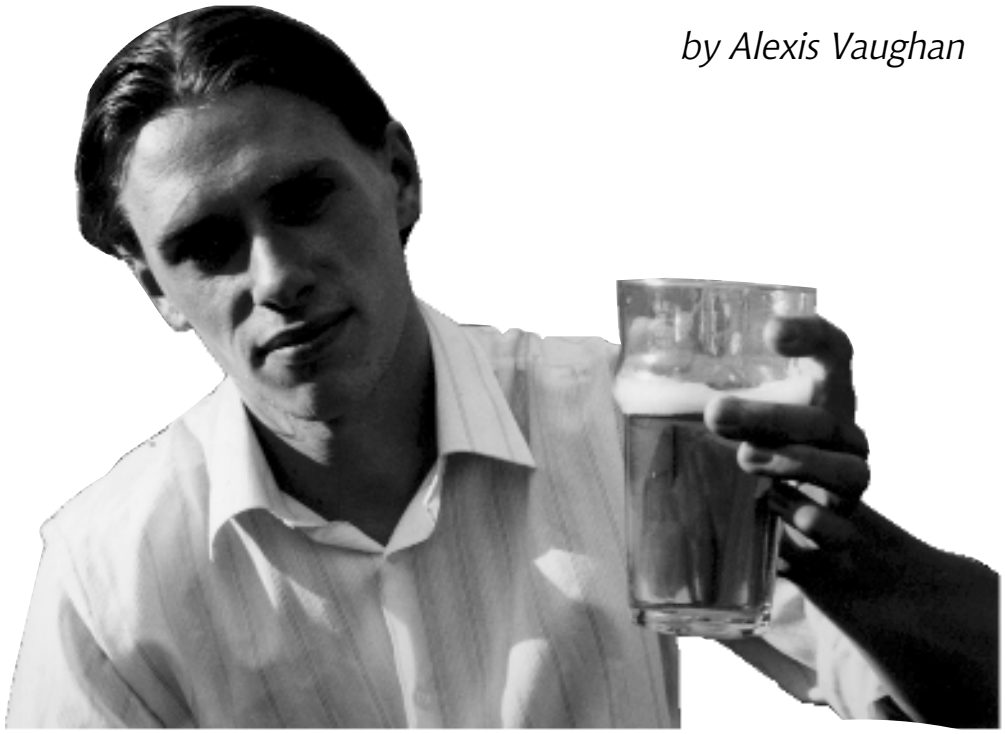
Bitter harvest, bitter beer

The impact of beer production and consumption on people and the environment

by Alexis Vaughan

Food Facts No 7



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Beer – what is it?

Ever since grain was first cultivated, probably before 5,000 BC, people have been brewing beer. As early as 3,000 BC, a sweet beer was being drunk by the Sumerians and Egyptians. Hops were first used to remove excessive sweetness in 700 AD in Bohemia and the Hallertau region of Germany, and have been used in Britain since the 15th century (see *The history of hops in the UK).*

A typical Kent oast house used for drying hops. Most have been converted into fashionable places to live.

The ingredients

There are four basic ingredients to beer: malted barley, hops, yeast and water. In most countries, except Germany (see *The Reinheitsgebot*), other ingredients are usually added, including sugar from sugar beet or sugar cane (to increase the amount of fermentation), and a range of additives.

Hop flowers, pellets and extracts

Hops provide the bitter flavour and aroma of beer, and in the UK hop cones are harvested in September. The plant is then fed into picking and sorting equipment to separate the cones from the stems and leaves. As the cones are relatively fragile, careful handling is needed throughout the process. Traditionally the hops are dried in an oast house to reduce moisture content from 80% to 10%. Hops are then bagged up and sent to breweries for further processing.

Seventy-five percent of all hops are processed to increase the uniformity of the beer produced. Converting hop flowers into pellets is the simplest and cheapest form of processing. Stored correctly, pellets will only degrade at one tenth the rate of loose hops and occupy one quarter of the volume. Pellets are also easier to handle and can offer significant savings in the cost of bittering. Not surprisingly then, in 1995, 50% of English grown hops were turned into pellets, with a quarter being processed into hop extract and only the remaining quarter used as whole hops[3].

Some experts claim that processing hops removes many of the traditional flavours. Most breweries now simply pour a thick liquid made from extract of hops into the beer.

Yeast

Yeast is a microscopic fungus that is used for fermenting the sugars in the malt and converting them into alcohol and carbon dioxide. Genetically modified yeast has been approved for use by the UK government in the production of beer, but it is not currently used by breweries.

Water

The water used in the production of beer is at the heart of a pint. Traditionally many breweries were located on natural springs, such as Burton-on-Trent, where the water produced good quality beer. Today, breweries are set up in all locations, so to ensure that the water still produces a quality pint of beer, the water is treated with additives. For example, chlorine is removed by adding potassium metabisulphite or by passing the water through activated charcoal. Brewers dislike hard water and bicarbonate ions are used to soften it, and potassium chloride or calcium chloride is added to water to brew darker beers. Gypsum can also be added to increase both the sulphate and calcium levels, and magnesium sulphate is sometimes added to increase the amount of magnesium ions.

Good and bad news for vegetarian beer drinkers

Most beers use finings to remove the yeast sediment from a beer. Finings are electrically charged and attract yeast residues. Both finings and yeast then sink to the bottom of the cask. Finings are usually made from the fish swim bladder (traditionally sturgeon) the best of which come from Russia. There have been a few alternatives used, such as seaweed extract, in the organic beer by Sam Smith Breweries and German organic beers produced by Pinkus Muller GmbH. Generally these have not proved to be popular with breweries so beers are hardly ever strictly vegetarian. However, some vegetarians turn a blind eye to such news, particularly as beer is an excellent source of the vitamin B12 (from the yeast).

The processes

The flavour of beer depends on a number of factors such as the types of malt and hops, the use of other ingredients, and the variety of yeast. The age-old process of brewing is summarised in the table: '*Brewing ale the tradtional way'*.

The main difference between ales and lagers is the type of fermentation used. Lager beers use a bottom-fermenting yeast which sinks to the bottom of the fermenting vessel. Fermentation takes place at a cooler temperature. Ales, which include stouts, milds, bitters, old ales and barley wines, are fermented at a warmer temperature. The yeast forms a thick head at the top of the fermenting vessel.

The Reinheitsgebot - the German beer purity law

The Reinheitsgebot is the German beer purity law which prohibits the use of any materials in brewing other than malted barley, hops, yeast and water. It was introduced in Bavaria in the 16th century and spread throughout Germany shortly after. Four hundred years later in 1987 the European Commission ruled the legislation inadmissible and, since that date, Germany has had to allow "impure" beer to be bought and sold in Germany. However, as a result of the Reinheitsgebot, the beer from Germany became some of the best quality produced in the world and, to this day, all German brewers still produce their beer according to the same legislation.

Preparing and serving cask-conditioned ale in the pub

Every cask of real ale has two holes for plugs, usually made of wood, to be inserted. A hard wooden peg seals the cask, whereas a soft wooden peg allows carbon dioxide to escape. In this way the cellar person can carefully monitor the natural carbonisation of the beer, preventing a flat beer or a beer with a nasty bite. When the fermentation is complete the cellar person has to check that the beer is clear, that it has the right level of carbonisation and has lost any unpleasant young flavours. For strong beers, beer may not have to be drunk for a week or more, but with most beers the cask must be finished within a few days. So for cask-conditioned ale to be at its best, there should be a high turnover in the pub.

The history of hops in the UK[2]

822: First reference to hops in England. However hops were not used in general use until the 15th century.

1520: The weavers of Flanders settled in Kent, bringing new varieties of hops and the knowledge of how to use them in beer.

1552: Edward VI passes legislation to allow hops to be used in brewing. Prior to this King Henry VIII had outlawed their use in brewing. Beers in Tudor times were strong, sweet brews of malted barley flavoured with spices, herbs and the bark of trees.

1665: Hops being grown in 14 counties.

1710: Duty on hops imposed for the first time. Smuggling hops becomes a valuable business.

1870: Around 29,000 hectares of hops under cultivation in 53 counties in Great Britain. New varieties, such as Fuggles, being introduced.

1932: Hops Marketing Board set up to ensure a sheltered market for hop growers. Abolished in 1982 by European Commission.

1995: Two hundred farmers grow 3,088 hectares of hops. Dwarf varieties of hops introduced.

Brewing ale the traditional way

Making Malt:	Germination	The grains of barley are soaked in water and allowed to germinate. They are then heated and turned regularly on the floor (or in large drums).
	Stopping germination	When the sugars have been extracted from the malt, the barley grains are heated in a kiln which stops germination. The degree of heat affects the type of malt produced and the flavour. Malt provides the colour, flavour and body of the beer.
	Adding other ingredients	Sugar is often added. Other additives improve the appearance of the head, assist fermentation or act as preservatives.
	Mash Tun	The malt is crushed into a powder and mixed with hot water to form a thick porridge liquid in a mash tun while the sugars dissolve.
Brewing:	Wort	When the liquid has absorbed enough sugars the liquid, called wort, is run out.
	Adding Hops	The wort is then boiled with hops, traditionally with the whole flower head in a 'copper', a large copper vessel for an hour.
	Hopped wort	The hopped wort is filtered over a bed of boiled hops and then allowed to cool.
Fermentation:	Yeast	Yeast is added to the cooling liquid. Within a few hours a scum will appear on top of the wort. The traditional yeast used is *Saccharomyces cerevisiae* at a temperature of between 18°C and 22°C.
	Green beer	After fermentation the 'green beer' is left in conditioning tanks for a few days while the remaining yeast continues to turn from sugar into alcohol.

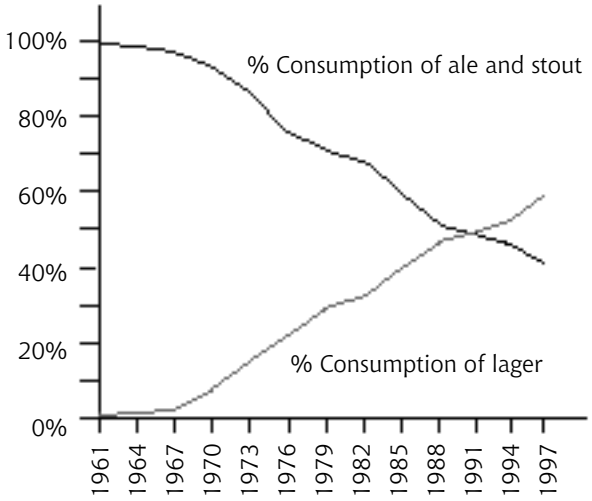
Keg beer compared to cask conditioned ale

	Keg beer	Cask conditioned ale
What is it?	The main aim of 'Keg Beer' or brewery-conditioned beer is to produce a beer with a long shelf life. It is favoured by big companies selling large amounts of beer, since little skill is required to maintain the quality once it has left the brewery and the beer is of a standard quality.	Cask conditioned ale or 'Real Ale' undergoes a second fermentation in the cask. Real ale cannot be preserved for a long period and requires skilled care and attention in the pub.
How is the beer conditioned?	All conditioning of beer is carried out in the brewery. Beer is chilled and filtered to remove all the yeast, and pasteurised to make a sterile product. Finings are also used.	The ale is placed in metal casks, though traditionally wooden casks were used. Sugar is added to encourage further fermentation and some beers are 'dry-hopped'. This means a handful of hops added to give extra aroma. Finings are also added. The finings sink to the bottom of the cask, which is then sealed. The beer then undergoes a second fermentation within the cask which is transported to the pub.
What is the effect of this conditioning?	The filtration and pasteurisation dramatically change the flavour and character of the beer. Pasteurisation is also responsible for giving the beer a burnt-sugar flavour.	The flavour is preserved within the beer.
What about the gas in the beer?	The conditioning also removes the natural carbon dioxide. Breweries therefore need to replace this gas to ensure it can be dispensed in the pub with excess CO_2.	The gas found in the beer is the natural carbon dioxide which is produced from the yeast fermenting the malt.
What is nitro-keg beer?	Most beers now replace the lost CO_2 with a mixture of nitrogen (75%) and carbon dioxide (25%). This produces a creamier and less fizzy bear. However it also removes bitterness and flavour.	A few ales are now nitro-keg but many do not consider them to be traditional real ale.
What happens when the beer arrives in the pub?	Simply connect the keg of beer to a cylinder of gas.	The beer needs to continue its second fermentation. The cask is placed in a deep cool cellar. The beer should not be used for anything between 1 and 4 days depending on the beer. See Preparing and serving cask-conditioned ale in the pub.
What temperature should beer be served at?	Serve cold at around 5°C	Real ale should be served at between 12°C and 14°C, cellar temperature.

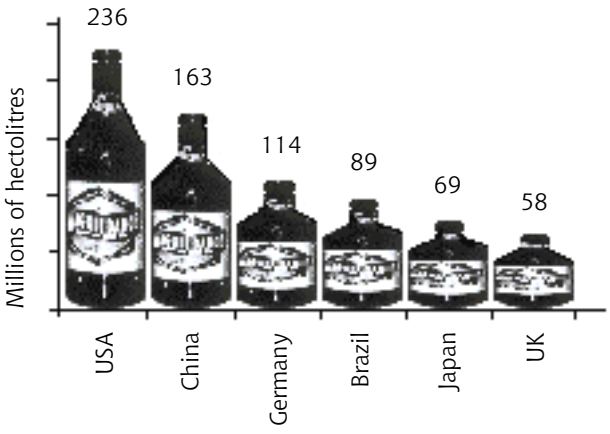
The end results

Aficionados of beers are sure that traditionally produced ales have a superior taste. However over the last 20 or 30 years the range of ales available has been reduced, as the brewing industry has consolidated (see the table: '*Pubs and breweries*') and more and more of its production has moved over to keg beer. The major brewers argue that customers want a consistent pint, and that is what they provide. Beer experts argue that customers don't want a consistently tasteless product, and that's why they are deserting real-ale and trying a wide range of other drinks. Whatever your views, the graph below shows that there has certainly been a dramatic decline in the proportion of ales drunk.

UK beer sales: ales versus lagers[4]



Which countries produce the most beer?



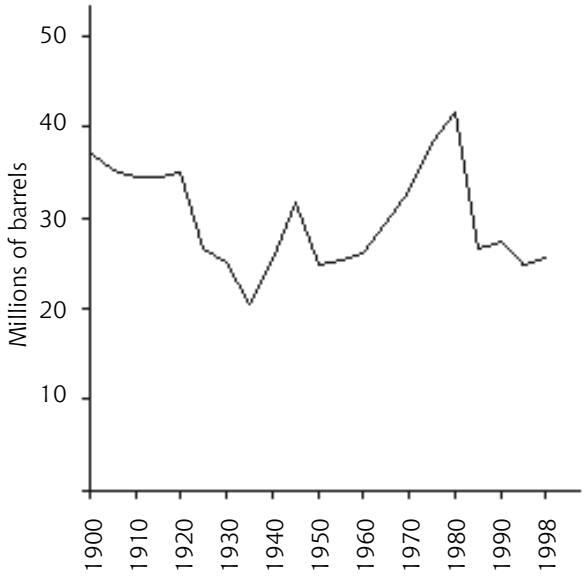
The taste of beer

Cask: These two pictures are of beer poured at the same time. The glass on the left shows a cask conditioned ale poured using a handpump. The glass on the right shows exactly the same ale but cooled with a nitrogen/carbon dioxide mixture added (see "What is nitrokeg beer?" in the table: '*Keg beer compared to cask conditioned ale*').

The author did a taste-test of these beers. The cask conditioned ale had flavour served at a cool temperature. The foam in the glass disappeared within a few minutes of being served. The nitrokeg glass tasted very cold and comparatively very bland. There was also a slight metallic flavour. The head in the glass remained in the glass after 15 minutes. However, others may prefer the nitrokeg beer, as its lower temperature can be refreshing and its taste is uncomplicated. The brewers have noticed this and started brewing their main ales as a nitrokeg.

Bottles: Beer has traditionally allowed for the second fermentation to occur within the bottle. However the Shepherd Neame Brewery (see Case Study) received so many complaints about the sediment in the bottom of the bottle, that the beer is now filtered first before bottling. Some people say that the taste of the beer is now slightly inferior. A number of breweries do still produce bottle-conditioned beer, such as the Hampshire Brewery which sells Pride of Romsey. The bottle states on the side *"To serve - store bottle upright to allow sediment to settle. Pour carefully into a pint glass to leave sediment behind".*

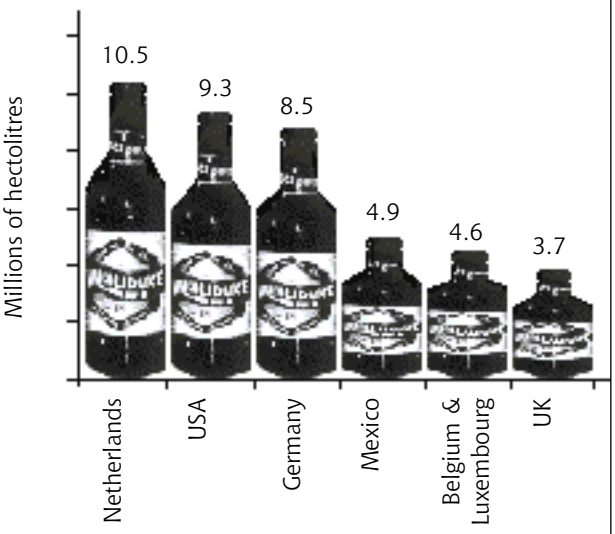
UK production of beer 1900 - 1998[5]



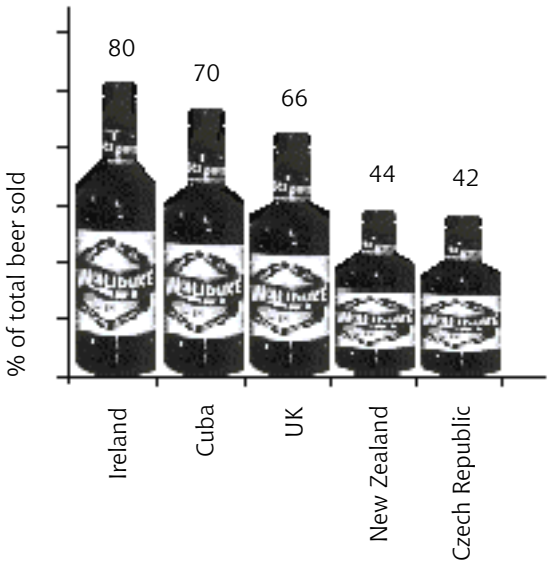
NOTE 1: Since 1993 a new beer duty system was used based on volume and alcoholic strength of the finished product which replaced measuring before fermentation. A 6% wastage allowance was allowed under the old system which was abolished. The figures have been corrected back to 1985. Therefore there may be a slight discrepancy before and after 1985.
NOTE 2: 1 Barrel = 288 pints = 5,760 fl oz. = 170 litres

Who consumes the most beer in the world?

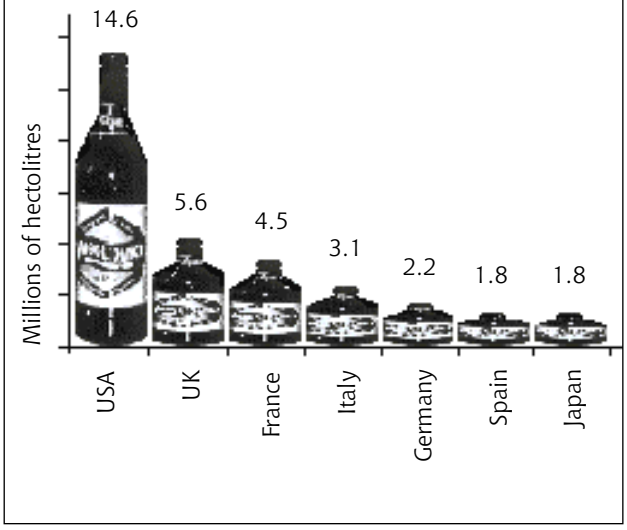
Which countries export the most beer?



Which countries sell the most draught beer (on tap)?



Which countries import the most beer?



Beer and the environment

The two main ingredients: hops and barley

Hops

The hop is an essential ingredient in beer as it provides the bitter and other flavours, as well as acting as a preservative. The plant, *Humulus lupulus,* is native to Europe and western Asia and is distantly related to the hemp and nettle plants. Hop plants are either male or female, and it is only the females which bear the volatile oils (important to the flavour of beer) and alpha in the resin (which give beers the bitterness).

Production in the UK

The majority of hops are grown in Kent and Herefordshire as shown in the map. The hops in these areas are usually grown as a small part of the farm business providing an extra income for the farmer, and increased local employment.

Between 1987 and 1998 hop production declined by 42%, from 4,217 hectares to 2,447 hectares[9]. The Case Study: *Three generations of hop production* illustrates, through one family's experience, the extent of the collapse in the industry. Hop production on a global level has also declined. In the USA pests and diseases have dramatically reduced the amount of hops produced (though it still produced 17,500 hectares in 1998), and Germany too has suffered losses (though it remains a major producer, with 22,000 hectares in 1998). As prices are not affected significantly by transportation costs, breweries in the United Kingdom can easily buy hops from anywhere on the world market if the processing quality and price of the crop are advantageous. The table above reveals that imports of hops have increased since 1987 with 30% of all hops imported in 1995.

Pests, diseases and pesticides

Modern varieties of hops have a very high alpha-acid content (for bittering hops) and are often resistant to many fungal diseases including downy mildew, powdery mildew and verticillium wilt. In the early 1990s a new dwarf hop variety was released which grows to only half the 4-6 metres of normal hops.
The main pests and diseases which affect hops are: the damson-hop aphid, downy mildew, powdery mildew, verticillium wilt, rust mite, and the spider mites (two-spotted and red). Many of the hop varieties are resistant to some of these diseases, though downy mildew tends to still be a problem. Aphids and spider mite have also been difficult to control, and are often affected by weather conditions, which determines the amount of pesticides used. For example the damson-hop aphid has not been a problem for the past four years, due mainly to wet conditions.

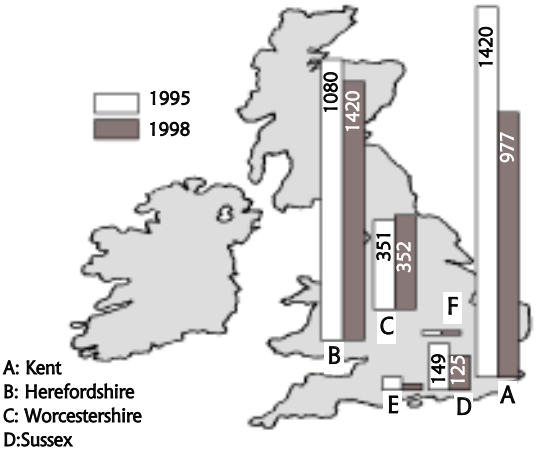
20 years of environmental improvement in the British brewing industry?[6]

The Brewers' and Licensed Retailers' Association recently claimed that 'significant progress' had been made over the past twenty years towards reducing energy and water usage in the brewing industry. The biannual study found that:

Natural gas provided over 63% of the total energy but created only 42% of the total CO2 emissions. Electricity is responsible for most of the CO2 emission providing only 21.8% of the energy.

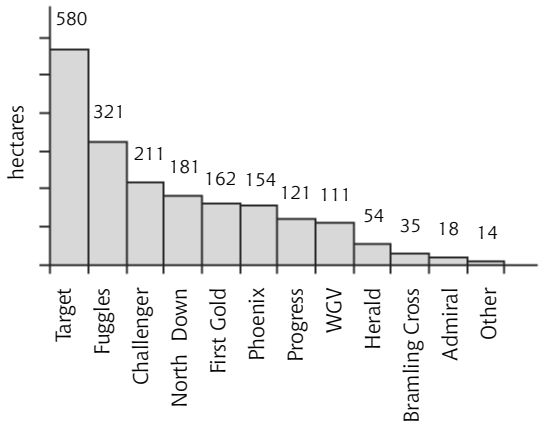
Water consumption has reduced from 9 pints to 6 pints of water used for every pint of beer produced.

Area of England under hops[7]



A: Kent
B: Herefordshire
C: Worcestershire
D:Sussex
E:Hampshire (59 and 28)
F: Oxfordshire (24 and 24)

Varieties of hops distributed in England (1998)[7]



Pesticide use on hops

In 1992 (the last MAFF survey on pesticide usage on hops), 51% of the total area of hops treated by pesticides were sprayed with fungicides, 18% with herbicides, 25% with insecticides and aracicides (mite control) and 6% with defoliants. In the same survey MAFF found that the average farmer would spray the hops 16.7 times with an average of over 28 pesticide products[10]. Dr Peter Darby of Horticulture Research International (see Contacts) currently estimates that although the number of annual sprays is still between 12 to 14, there are only around 15 pesticide products used on average. Indeed most of the organophosphates and pyrethroids and now no longer used by hop farmers, and there is a concerted effort to reduce pesticide inputs,mainly for economic reasons.

The effects of the pesticides on the environment is well known, and is illustrated in the photographs. The first shows an organic hop field and the second a non-organic hop area, both taken within a few weeks of each other. The conventional hop field uses herbicides as traditionally, the land cannot be ploughed to control the spread of verticillium wilt. Aphids are usually controlled by an aphicide, which is systemic (working within the plant) and is claimed to be innocuous to other insects.

Organic hops with mustard grown underneath. The mustard attracts aphids, which in turn attracts predators who are then ready to consume the damson-aphid, which arrives later in the year.

Conventional hops have a 'scorched earth' look, mainly to control the spread of *Verticillium wilt*, a soil borne disease.

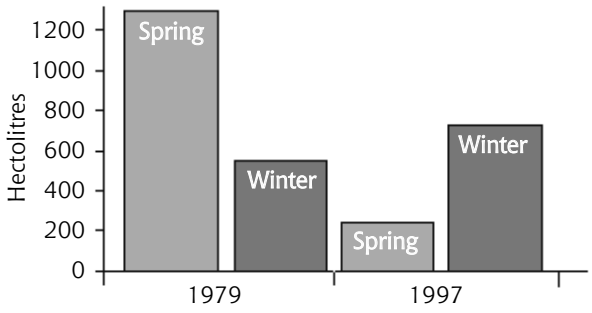
Hops: area, yield, production and supply[8]

	1987	1989	1991	1993	1995
Area (hectares)	4,217	3,923	3,696	3,428	3,281
Yield (tonnes per hectare)	1.31	1.26	1.71	1.62	1.33
Production ('000s tonnes)	5.5	4.9	6.3	5.6	4.4
Imports('000s tonnes)	2.2	2.2	1.6	2.6	3.0
Exports('000s tonnes)	0.8	2.2	1.4	1.1	1.1
Total Supply ('000s tonnes)	6.9	4.9	6.5	7.0	6.2
Home Production as a % of total supply	79.8	100.0	96.9	79.1	70.0

Case Study: Three generations of hop production

The Tompsett family has been growing hops for three generations in the South East of England. In 1996 the family grew 40 hectares of hops, 37 hectares in 1997, 7 hectares in 1998 but in 1999 only half a hectare. None of these hops are used to produce beer. Instead they are sold, ironically, to passing tourists as a souvenir of Kent - a memento of a dying industry. *"It's a very difficult time for hop farmers in the UK with breweries now importing cheaper hops from abroad. Hops from abroad are also of excellent quality originating from the USA in Oregon, California and the Yakayma Valley in Washington State"* says David Tompsett. *"We're just waiting for the UK hop market to pick up again"*. Fortunately, the European Commission is paying David Tompsett a 'resting grant' to ensure that the frames of wooden poles and wires are not removed. This means as and when the hop market recovers, the family will be able to re-enter the industry.

The switch from spring barley to winter barley[12]



Production of barley in the UK[11]

	Average (1987-89)	1994	1995	1996	1997	1998 (provisional)
Area ('000s hectares)	1,788	1,108	1,193	1,269	1,359	1,255
Yield (tonnes / hectare)	4.86	5.37	5.73	6.14	5.76	5.21
UK production ('000s tonnes)	8,693	5,952	6,842	7,789	7,828	6,537
Total used in UK ('000s tonnes)	6,437	5,365	5,618	5,967	5,651	5,544
% used for brewing and distilling	28%	33%	34%	33%	34%	36%
% used for animal feed	66%	62%	61%	62%	61%	60%

Pesticide usage on spring and winter barley in Great Britain, 1996[13]

	Barley	Insecticides	Fungicides	Herbicides	Growth Regulators	Molluscicides	All
% area of crop treated with pesticides	Winter	71.7	94.1	96.3	63.4	4.1	-
	Spring	7.6	79.1	95.5	9.8	0.4	-
Number of spray rounds applied	Winter	0.9	2.1	1.8	1.1	<0.1	4.0t
	Spring	0.1	1.3	1.4	0.1	<0.1	2.3
Number of products applied*	Winter	0.9	3.4	2.6	1.1	<0.1	8.1
	Spring	0.1	2.0	2.2	0.1	<0.1	4.4
Number of active substances applied*	Winter	0.9	4.9	3.6	1.4	<0.1	10.7
	Spring	0.1	2.7	3.3	0.1	<0.1	6.2

* includes repeat applications

Case Study: The solitary UK organic hop farmer

Peter Hall is a fruit farmer in Marden, Kent. He is also the only farmer in the UK growing organic hops. Target Farm is 120 hectares with only one hectare used to produce organic hops. Other crops include apples and pears, produced using both organic and IFP (Integrated Fruit Production) techniques.

A mustard crop grew between the rows of hops to provide both a place for predators to live and a green manure for the following year. Other weeds grow around the crop which therefore looks very different to a non-organic hop area, which tend to have bare soil beneath the hops. At the top of each pole are cut plastic bottles. These are used to hibernate lacewings over winter to ensure that these predators are ready to eat their share of aphids. Peter Hall showed tiny eggs on many of the leaves, proudly proclaiming them to be the eggs of a predator such as one of the many varieties of ladybird. These predators play an important role in the protection of organic hops, and an important part of that protection is to keep them in the hop field. Populations of aphids should not be wiped out, as a balance of aphids and predators is needed.

The hops are Wye Target which are tolerant to verticillium wilt and resistant to powdery mildew. However, they are susceptible to downy mildew which is controlled by frequent sprayings of copper oxide. It is likely that copper-based sprays will be banned from organic farming in 2002 and Peter Hall admits that growing organic hops will be very difficult unless a substitute can be found by then. Aphids are controlled by Savona (an insecticidal soap) which is applied, if needed, when it rains to increase its effectiveness. His main problem is spider mite which has no natural predators. This can be controlled by spraying with the non-indigenous bacteria *Phytoselius persimillis* but unfortunately this is not effective with the tall varieties of the hop. Indeed, Peter Hall would be happy to convert his hops to the dwarf variety for this very reason, but the costs are prohibitive without a guaranteed buyer.

As Peter Hall says, "Hops require huge capital investment and large companies are not interested in long term commitments or partnerships with farmers. Growers therefore do not have the confidence to grow organic or non-organic hops. The irony is that hops make up a fraction of the capital cost for a brewery, as only small amounts of hops are needed. Breweries are now more interested in buying the cheapest hops possible, even if this means having to buy them in from New Zealand".

However, premiums for organic hops are very high and it is surprising that so few farmers have entered the market. In one hectare, a non-organic site will yield £2,000 worth of hops, while an organic site will yield five times as much, £10,000. Peter Hall has found that with time the organic hops need less attention, as the predators and pests become balanced in numbers and the fertility of the soil increases.

Peter Hall has proved that growing organic hops in the UK is feasible and beneficial to the local environment. His experience highlights the need for breweries to forge long term commitments with hop growers in England. The benefits of organic hops heavily outweigh the small increase in the price of a pint of organic beer, and purchasing those hops in England is an important step towards reducing the "Food Miles" of beer (see the section: 'Beer miles').

Peter Hall inspecting his organic hops

Hops intercropped with mustard

easier to grow in drier temperate areas, as high rainfall can wash out much of the nitrogen from the soil.
It is surprising that so few organic beers exist given the high and rising demand for organic food and drink in the UK. At the time of writing there are three organic beers brewed in the UK: Golden Promise by Caledonian Breweries, Organic Best Ale by Samuel Smith Breweries and, most recently, EcoWarrior by Pitfield Breweries in London. Brakspear Breweries in Henley-on-Thames is also considering brewing an organic beer. Also available in the UK are a number of imported organic beers (mainly quality lagers), particularly from Germany such as Bucher's organic pilsner and Pinkus Muller GmbH Organic Beer.

Organic beers may be a way for family-run and other small or microbreweries to market their beers. However, ideally, organic beer should include other factors such as reducing the number of beer miles (see below), introducing and supporting long-term commitments for British organic farmers, and incorporating the use of other environmental measures such as reusing bottles. Sam Smith Breweries, for example, import their organic hops from New Zealand. With more forward planning and long-term agreements with farmers, organic hop and barley production could increase in the UK.

Pinkus' Organic Beer - *"Ingredients: Water, organic Barleymalt, organic wheat malt, and organic hops. Packaging materials are made from recyclable glass, recycled paper and chemical-free ink. Use of PVC inside the crown top and aluminium foil is prohibited"* - It's not just what's in the bottle.

Sam Smith Organic Best Ale - *"Ingredients: water, organic malted barley, organic cane sugar, yeast. organic hops, seaweed finings, carbon dioxide"*

The environmental benefits of organic farming

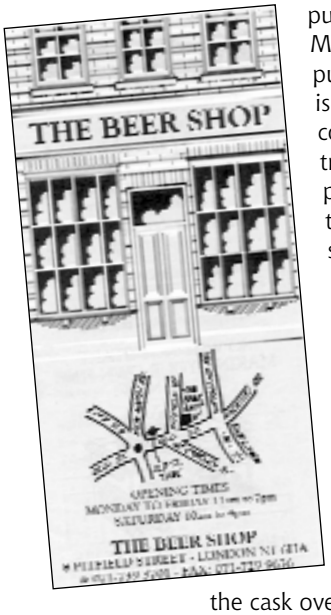
There have been several studies that show the benefits of organic farming on the environment as compared with conventional farming systems. One case study by East Anglia University[18] showed that during the conversion period there were *"demonstrable reductions in overall environmental impacts associated with the conversion, [to organic], with evidence of increased species diversity..."*. The study also found that regardless of the farm being organic or conventional, farm management practice strongly influenced the environmental impact. The study found that populations of butterflies and other beneficial insects were all more abundant on the organic farms, though higher aphid populations existed on conventional farms. There is also little doubt that the use of pesticides by farmers has also caused bird populations to decline. Campbell and Cooke in 1997[19,20] showed that there was evidence of an indirect link between pesticide use and bird populations, and Potts in 1986[21] proved a direct link between partridge populations and pesticide use.

A farmer needs to create a balance in the field of both predators and pests. Aphids are needed throughout the season to ensure that the predators (such as ladybirds) do not leave or die out. However aphid populations need to be kept at a level which does not excessively damage the crop.

Case Study: The Pitfield Brewery - brewing an organic beer

In 1982 Pitfield Brewery started brewing cask-conditioned ales at The Beer Shop, and five years later they won the Champion of Britain award with their Pitfield Dark Star. The shop now stocks over 500 types of beer from around the world, and 10 of these are organic.

All the beer produced from the brewery is sold to carefully screened local pubs in London within the M25. The reason that the pubs are carefully selected is to ensure that the cask conditioned beer is treated correctly by the publican to guarantee that the customer is served a good quality pint. Over a quarter of all the beer brewed on the premises is sold in The Beer Shop.



Pitfield brewery brews an organic beer called EcoWarrior. The beer is also vegetarian as no finings are used - the yeast is allowed to settle to the bottom of the cask over a period of time. The bottled EcoWarrior is also bottle-conditioned. The Hallertau hops are imported from New Zealand and the barley is from Scotland, though Pitfield Brewery is keen to buy all its organic ingredients from the UK.

Pitfield Brewery is a small brewery, producing around four barrels a week, and is keen to see a Progressive Beer Duty (see the section 'Taxes' on page 19) introduced as they find it difficult to compete with the big brewers. For example large brewers would sell their beer with up to 45% discount compared with the Pitfield Brewery, both paying the same level of duty. Pitfield Brewery therefore focuses on producing good quality and organic beers, and is considering using organic ingredients in all its beers.

For more information about Pitfield Brewery and The Beer Shop - see Contacts.

Beer miles

The phrase *Food Miles* (or in this case, *Beer Miles*) is a shorthand way to describe the distance that ingredients travel before they reach you, and they are a good indicator of environmental sustainability. Food and drink which is transported longer distances causes higher levels of pollution and often leads to more intensive production methods[22].

The ingredients in beer, and beer itself, are often transported long distances. The UK export market for beer was worth around £216 million in 1997 and imports were worth over £290 million in the same year[23]. With the rise of global beer brands it is not surprising that beers are increasingly being imported and exported.

UK imports and exports of beer[24]

Thousands of Barrels

	Imports	Exports
1993	2,800.1	1,283.4
1994	3,160.4	1,936.1
1995	3,174.2	1,844.8
1996	3,416.4	2,233.0
1997	3,350.3	1,889.5

NOTE: 1 Barrel = 288 pints = 5,760 fl oz. = 170 litres

If the beer industry continues to consolidate (see *Pubs and Breweries* below) the number of beer miles will probably increase. In general, if beer is from a large brewery it is likely to have travelled further than if it came from a small or micro-brewery. The example below shows two extreme possibilities.

Main Ingredients	Example of low food miles	Example of high food miles
Malt	Barley* from Scotland	Barley from USA
Hops	Hops* from Kent	Hops from New Zealand
Water	Local to brewery	Local to brewery
Yeast	At brewery	At brewery
Sugar	East Anglia	Australia
Location of brewery	Local village	Germany
Estimated total number of food miles	600 miles	24,000 miles

*Organic hops and barley are also likely to have fewer food miles in their production than non-organic, as fertilisers and pesticides do not have to be transported.

A bottle of beer

The casks in pubs are always re-used, as are the glasses we drink from, making this the best option for the environment. However, the graph shows that this way of consuming beer has been declining since the 1980s, to be replaced by non-returnable cans and bottles. Arguably the most dramatic change has been the collapse in the proportion of returnable beer bottles used, from a third in 1961 to a mere 2% in 1997. It doesn't have to be like this, as the *Case Study: The Danish beer bottle* illustrates.

Did you know?[26]

There are 24 large, 70 medium to small and 500 microbreweries in the UK

Total annual production was 57 million hectolitres with a market value of around £15 billion

35 million cubic metres of water per annum is used in the brewing process

The annual energy bill in breweries is £35 million and CO_2 emission weighed 825,000 tonnes

Case Study: The Danish beer bottle

In July 1981 Denmark introduced a new recycling scheme which limited the types of bottles used for beverages. Restrictions on the shape of the bottle were introduced to ensure that the new recycling system was both efficient and successful. Only 30 shapes were approved and all were made of glass. Legislation was needed because the voluntary re-use system which had existed had begun to disintegrate, as Danish beer manufacturers started to use cans and different shaped bottles. The Danish government decided that the benefits to the environment exceeded any costs that might be incurred by beer and soft drink companies.

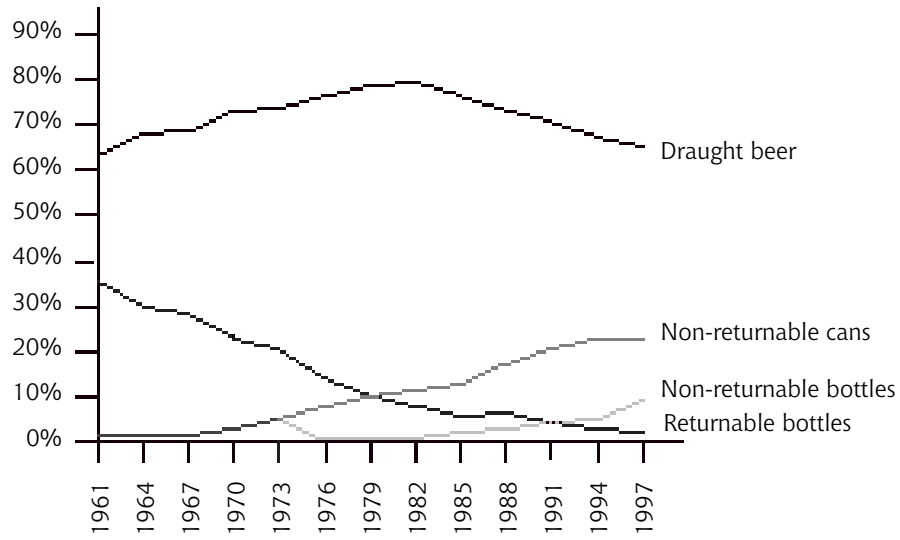
In fact, Danish manufacturers supported the legislation as they had already begun to adopt the new bottle shapes, but manufacturers outside Denmark, particularly in Germany, complained of unfair competition. The case was brought to the European Court of Justice who found in favour of the Danish government since the Danish law did not discriminate between imports and domestic manufacturers. As a result of this important ruling, other EC member states, such as Italy, Austria and Germany, are now implementing similar legislation.

This is not surprising, as the legislation has been very successful. Customers return the bottles for a refund on a small deposit, and around 99% of all glass bottles are re-used, some up to 30 times.

For more information see the web on: http://gurukul.ucc.american.edu/ted/danish.htm

Beer sales by type of packaging (percentage)[25]

Note: Prior to 1974 differences between non-returnable cans and bottles were not given.



Poison chalice?

The UK government has estimated the cost of alcohol to the health, welfare and criminal justice services at around £10 billion per year. This represents not only deaths from alcohol-related diseases, accidents and violence, but untold suffering both from illness and by the family and friends of those affected. The World Cancer Research Fund concluded, in their report *Food, Nutrition and the prevention of Cancer,*[27] that the more alcohol consumed, the greater the risk of becoming ill with cancer. The report recommends that consumers abstain from all alcohol or consume low quantities and notes: *"It is estimated that one in five hospital beds [in Europe] is occupied as a result of diseases or disorders in which alcohol plays a contributory part".*

At the same time, there is no doubt that alcohol, including beer, is an enjoyable part of life for most UK citizens. The carnage caused by excess alcohol consumption could be prevented if people drank sensibly. Indeed, studies have shown that beer drinking in moderation does not endanger human health. Heavy drinking, on the other hand, is directly related to premature death as the table: '*Heavy drinking, higher risk'* shows.

Part of the reason why people have difficulty staying within sensible drinking limits is because they are not aware of what the limits are, or how their drinking habits fit these limits. Around 21 units of alcohol per week is the upper limit for men, and around 14 alcohol units per week is the maximum for women (because they tend to be smaller and women cannot metabolise alcohol as easily as men). The table shows how many units of alcohol there are in a range of common drinks.

Heavy drinking, higher risk

A 21 year study by the University of Glasgow[28] analysed the drinking habits and health of 5766 Scottish employed men, taking account of other risk factors (such as smoking) and socio-economic factors. The study found that men drinking up to 14 units of alcohol (7 pints of beer) per week showed similar mortality rates to non-drinkers. Above this level there was a graded association between higher mortality risk and alcohol consumption.

There was no clear link between alcohol consumption and death from coronary heart disease, but there was a strong correlation with fatal strokes. The study also found that men who drank more than 22 units (11 pints) a week were putting their health at significant risk, while those men drinking more than 35 units (17 pints) a week double their risk of premature mortality compared with non-drinkers.

Units of Alcohol[29]

Drink	Units
1/2 pint of beer	1
1/2 pint of strong beer	2
1/2 pint of lager	1
1/2 pint of stout	1.5
1/2 pint of cider	1.5
1 glass of wine (9% abv)	1
1 glass of wine (12% abv)	1.5
1 measure of spirits (40% abv)	1

Why are ingredients not listed on beer?

Since 1979, under European legislation, the additives and ingredients used to make drinks have to be declared on the label, but only if the drink contains less than 1.2% alcohol. Beer may contain many ingredients to improve the head on beers, increase shelf life and impart better colour and flavours. Other additives include sulphite preservatives, artificial sweeteners, enzymes and stabilisers, but these ingredients are not shown on many popular beers. Many breweries even claim that it may be illegal to list the ingredients. A few of the smaller breweries, however, do proudly list their ingredients.

In 1997, amendments were suggested to the 1979 EC legislation to ensure that ingredients are listed on drinks with more than 1.2% alcohol, though the proposal does not extend to listing all ingredients quantitatively. The proposal[30] even stated that the inclusion of ingredients which *"constitute more than 5% of the foodstuff [would] result in a surfeit of information which would confuse consumers".* There is obviously a long way to go before full quantitative ingredients are listed on beer bottles. For more information about labelling contact CAMRA and the Food Commission- see Contacts.

Pubs and breweries

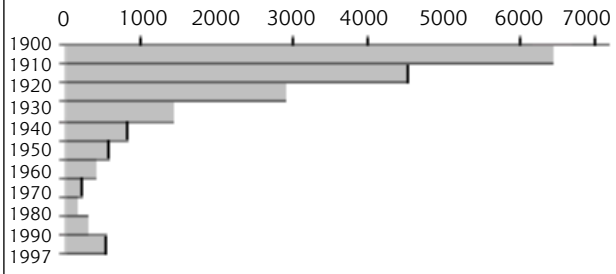
The brewing and pub industry has undergone radical changes in the past ten years. In March 1989 the Monopolies Commission produced a report entitled *The Supply of Beer* (known as the Beer Orders) which was to have far-reaching consequences for the industry:

A maximum limit was set on the number of pubs a brewery could own, leading to a separation between brewing and pub ownership. There are now over 200 non-brewing pub chains and the sector accounts for one-third of all pubs, shifting the balance of power from brewers to retailers.

Pub companies and breweries have concentrated on developing "theme" pubs and, in the process, many traditional pubs have been lost.

National brewers have diversified into other 'leisure activities' such as health clubs, hotels, restaurants, fast-food chains and casinos, and have reacted to increased competition by offering larger discounts to pub companies and consumers.

Total number of breweries in the UK[31]



Microbreweries - Success or bankruptcy?

Strengths	Weaknesses
High level of service	Lack of trade contracts
Potentially high quality	Reliance on free trade
Local identity of beers	Lack of financial backing
Free to innovate	Bad debts
Organise and participate in local beer festivals	Cash flow problems including late payments
Produce one-off brews and special beers such as vegetarian or organic	Lost casks
Contribute to diversity and consumer choice.	Loss of outlets to sell beer
	Lack of promotional activity

Breweries

In 1989 the six big brewers shared about 80% of the UK beer market. This monopoly of the market was supposed to improve after the Monopolies Commission Report, but by 1998 only four brewers dominated 83% of the market.

Microbreweries, however, have done remarkably well, thanks to their innovative marketing techniques, such as new ales and distinctive bottle shapes. So the dramatic decline in the number of small, independent breweries has been reversed in the last two decades.

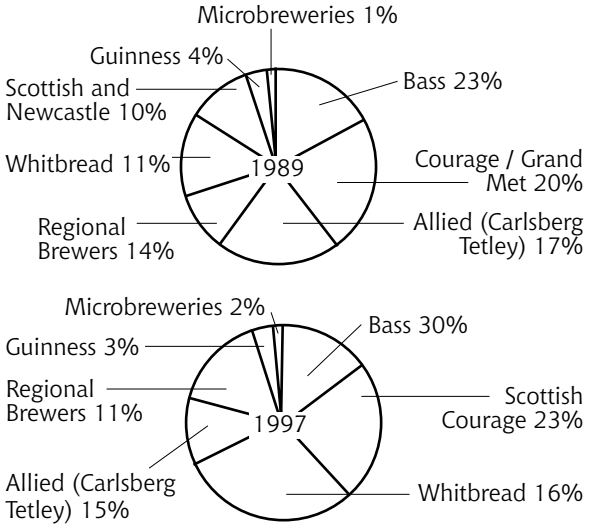
Microbreweries

Microbreweries have been the latest successful enterprise to challenge the dominance of the big four companies, but still their market share of beer production is only around 2%. The typical microbrewery is either a stand alone unit producing between 1000 to 5000 barrels a year or a pub with a brewery attached. The profit margins can be very tight and companies are very susceptible to bankruptcy. The table below summarises the strengths and weaknesses of the microbrewery.

The major threat to the microbreweries is that the national breweries will consolidate their market position by buying small and regional breweries and then closing them down.

Despite their problems the microbreweries have helped to provide more local jobs (often in rural areas), an extra income for farmers, support for local services, and of course, increased choice for local consumers of a variety of beers.

Market share by beer production for 1989 and 1997



Source: CAMRA - personal communication

The big four breweries - what they own in 1999

	Bass	Carlsberg-Tetley	Scottish Courage	Whitbread
Breweries (those crossed out have been closed)	Tadcaster (keg only) Cape Hill, Birmingham Burton Brewery (Burton on Trent) Manor Park, Alton (keg only) Wellpark, Glasgow Bass, Ulster ~~Welsh Brewers, Cardiff~~ ~~Cannon, Sheffield~~	Tetley, Leeds Carlsberg Brewery, Northampton Alloa ~~Wrexham Lager, Wrexham~~	Tyne Brewery, Newcastle Royal Brewery, Manchester (Keg only) John Smiths Brewery, Tadcaster Bristol Brewery* Berkshire Brewery, Reading (keg only) T&R Theakstons, Masham	Boddingtons, Manchester ~~Flowers Brewery, Cheltenham~~ ~~Castle Eden, Co Durham~~ Magor Brewery, Gwent (Keg only) Samlesbury (keg only)
Cask-conditioned ales	Draught Bass M&B Mild M&B Brew XI Worthington Dark Mild and Draught Bitter Hancock's HB Toby Cask Stones Bitter	Ind Coope Burton Ale Tetley Bitter Shipstones Greenalls Davenports	All Theakstons Courage Best and Directors McEwanYounger No. 3 John Smiths Bitter Magnet Webster's Green Label Yorkshire BItter	Boddingtons Flowers Best IPA Original Castle Eden
Lagers	Carling label Lamot Lager Tennent's Extra	Carlsberg Skol Castlemaine XXXX Wrexham Lager Tuborg Labatt Lowenbrau	Hofmeister Miiler Pilsner Holsten PilsColt 45 Budweiser Kronenbourg 1664 Carlsberg Genuine Pilsner Fosters Draught	Stella Artois Heineken Tooheys
Nitro-kegs	Caffreys	Calders	Gillespies	Boddingtons Gold

The brewing industry is highly dynamic and more changes will occur. This list is correct in the Spring of 1999
*Due to close in November 1999. Source: CAMRA - personal communication.

A selection of real ales by independent breweries

Case Study: The Shepherd Neame - the oldest independent brewery in the UK

The Shepherd Neame is said to be the oldest brewery in Britain, and has been brewing beer since 1698 in Faversham, Kent. Faversham is known to have been the site for brewing since the 12th century, using the local natural spring water. The Shepherd Neame brews cask-conditioned ales as well as lager under licence, including Oranjeboom, Sun Lik (a Chinese beer) and Kingfisher found in many Indian restaurants. The company also owns over 400 pubs in Kent, London, Surrey and Sussex.

Most of the cask conditioned ales are sold to the brewer's own pubs, and most of the bottles are sold to supermarkets and off-licences. The beer is also sold abroad including to Sweden, the USA, Russia, Italy, Canada, and South Africa. Ironically half a million bottles of beer are sold to French supermarkets in northern France, only to be sold to British tourists on a shopping spree! Bottles of beer in Calais sell for half the price of those sold in the UK (see *Taxes* on page 19).

Case Study: Old legends and a microbrewery in Leicestershire

The John O'Guant Brewing Company is based in Somerby, near Melton Mobray in Leicestershire. Celia Frew started brewing part-time in July 1997 and by June 1998 was able to concentrate on the brewery full-time. The first beer to be brewed was 'Robin a Tiptoe' and is still the brewery's best seller. The beer has also been very successful in a number of beer festivals, winning several awards. There are now three beers produced ('Cropped Oak' and 'Coat O'Red'). In November 1998, the company was able to buy an adjacent pub called The Old Brewery Inn.

The Old Brewery Inn, Somerby

The names of the beers all come from old Leicester-shire legends. For example the name Robin a Tiptoe is taken from a 15th century tale in which Robin was hanged for his crimes on the hill "Tilton Three Trees". However legend has it that Robin was so tall that the tips of his toes touched the ground... and then tip-toed to freedom?

Pubs

Most pubs in the UK are not owned by the large brewery companies but are now owned by specific pub companies, as shown in the table: 'Market share by pub ownership'.

The pub companies which, in 1998, had over a third of all pubs, are dominated by a few large companies, listed below in the table: *'The top ten pub owners in the UK'*. The Grand Pub Company, which is owned by the Japanese investment bank Normura, owns the largest share with over 5,000 pubs. Allied Domecq owns 3,750 pubs and Greenalls owns 2,230 pubs. The big brewers also own a similar number of pubs.

Market share by pub ownership 1989 - 1997

	1989	1997
Allied Domecq (no longer a brewer)	10.6%	6.1%
Bass	11.1%	4%
Courage	7.9%	-
Grand Met	8.7%	-
Scottish and Newcastle	3.8%	4.3%
Whitbread	10.1%	5.3%
Regionals	13.8%	19%
Pub Companies	< 1%	31%
Freehouses	34%	30%
Micros	-	0.2%

Source: CAMRA - personal communication

Did You Know?

If you feel that your pint is short in a pub, then you can ask for a top-up which has to be given with good grace. (If you have any problems contact your local authority Trading Standards Officer)

Did you know?

All pubs must be allowed to sell one guest beer of their choice. Even pubs which are 'tied' to breweries or pub companies can still serve a beer of their choice. However pubs are often presented with a short list by the parent company from which they can 'voluntarily' choose a guest beer. Guest beers on these lists tend to be cheaper and are not always from a local brewery.

Are you being served?

So, you may have just discovered that the beer you drink is owned by one of the major four brewers, and not an independent, and that the pub you drink in, despite its new name, is not independent either. And it might be even worse than you think. Although rare, and difficult to prove, there may be instances where pub customers are not getting the full value of their pint:

1. **Dilution:** Here the cask can be diluted with up to about 5% water before the average customer would notice. This is a rare practice but, as the pressure increases on the pub owner to get the full number of pints from each cask, so this will continue.

2. **Filter Back:** Here the beer from the drip trays is filtered back into the cask along with the first few pints pulled. Again this is rare, but it can affect the taste of the beer.

3. **Short Pint:** This is the most common problem, with some pubs providing 95% beer and 5% foam. After only 20 pints, one pint has been saved. Officially customers are entitled to a free top up with good grace from the pub, but this does not always happen. The Campaign for Real Ale (CAMRA) revealed that 1 in 4 pints are served short and that 80% of all pubs sold short measure pints. The easiest solution is, of course, to use legislation to enforce a full pint, but the beer industry has resisted such a solution. Most recently, the government has shown its intention to lay down legislation which will ensure that customers will receive a full pint in a pub.

The top ten pub owners in the UK, 1998

Name of Pub Chain	Number of Pubs
Nomura	>5,000
Allied Domecq	3,750
Whitbread (Brewery)	3,250
Scottish & Newcastle (Brewery)	2,641
Bass (Brewery)	2,500
Enterprise	2,270
Pubmaster	2,100
Punch	1,428
Greenalls	1,000
Century	500
Total	**24,439**

Source: CAMRA - personal communication

Case Study: CAMRA - promoting good beer

The Campaign for Real Ale (CAMRA) is a unique independent consumer organisation, with over 54,000 members. CAMRA is a non-profit body run locally and nationally and campaigns to promote high quality tasty beer and wider choice:

locally, to save individual pubs

nationally, on planning, licensing and tax laws

CAMRA also promotes distinctive beers through positive awards, over 145 beer festivals a year and campaigns for higher standards in breweries and pubs.

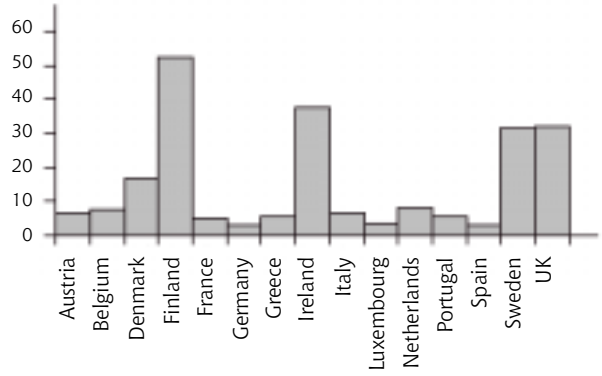
CAMRA produces the *Good Beer Guide,* edited by Jonathon Preece. The book lists over 5000 pubs in the UK which serve cask conditioned ales, 2000 varieties of beer and over 600 pub chains and breweries.

Taxes

UK excise duty on beer is one of the highest in the world, at 32 pence for each pint drunk. Given that one of our neighbouring European countries, France, has a duty of only 5 pence per pint, a large amount of beer is now being imported by individuals visiting supermarkets around Calais, and by smugglers profiting from the price differential.

Rates of excise duty on beer in the European Union[32]

ABV = Alcohol by volume, expressed as a percentage.



Since 1980 the Society of Independent Brewers (SIBA) has been campaigning for a Progressive Beer Duty (PBD), where smaller brewers would pay less tax than the largest. This progressive tax aims to enable smaller breweries to compete with the larger breweries, thereby creating more consumer choice, more jobs, and an increase in the diversity of beers manufactured and types of hops and malts grown.

The campaign was boosted in 1989, by the by the Monopolies and Mergers Commission report which recommended that such a system be introduced, and again in 1993, when the concept was enshrined in European law. A PBD system has been in operation in Germany for many years, and has also been introduced in the USA, and it appears to be very successful in supporting small breweries. So far, the UK Government has refused to implement it, despite calculations showing the cost of such a tax would be only 0.05% of the current beer tax.

Can real-ales and organic beer survive the next millennium?

Sustain: The alliance for better food and farming

(formerly the National Food Alliance and the Sustainable Agriculture, Food and Environment Alliance)

MEMBERS

Action and Information on Sugars
Arid Lands Initiative
Agricultural Christian Fellowship
Association of Public Analysts
Association of School Health Education Co-ordinators
Association of Unpasteurised Milk Producers
Baby Milk Action
Bio-Dynamic Agricultural Association
British Association for the Study of Community Dentistry
British Dental Association
British Diabetic Association
British Heart Foundation
Butterfly Conservation
Campaign for Real Ale
Caroline Walker Trust
Catholic Institute for International Relations
Children's Society
Common Ground
Commonwork Land Trust
Community Nutrition Group
Compassion in World Farming
Consensus Action on Salt and Hypertension
Council for the Protection of Rural England
East Anglia Food Link
Ecological Foundation
Ecologist
Elm Farm Research Centre
Farm Animal Care Trust
Family Farmers' Association
Farm and Food Society
Farmers' Link
Federation of City Farms and Community Gardens
FLAG (Food Labelling Agenda)
Food Additive Campaign Team
Food Commission
Food for Health Network
Friends of the Earth
Gaia Foundation
Genetics Forum
GMB (Britain's General Union)
Green Network
Guild of Food Writers
Health Education Trust
Henry Doubleday Research Association
Hyperactive Children's Support Group
Institute of European and Environmental Policy, London
Land Heritage
Local Authorities Co-ordinating Body on Food and Trading Standards (LACOTS)
Maternity Alliance
McCarrison Society
National Association of Teachers of Home Economics and Technology
National Confederation of Parent-Teacher Associations
National Council of Women
National Dental Health Education Group
National Farmers' Union
National Federation of Consumer Groups
National Federation of Women's Institutes
Northern Ireland Chest, Heart and Stroke Association
Oral Health Promotion Research Group
Permaculture Association
Pesticides Trust
Plantlife
Rural Agricultural and Allied Workers' Union (TGWU)
Scottish Crofters' Union
Scottish Federation of Community Food Initiatives
Society of Health Education and Health Promotion Specialists
Soil Association
Townswomen's Guild
UK Public Health Association
UNISON
Vegetarian Society
West Country Graziers
Wildlife and Countryside Link
Willing Workers on Organic Farms
Women's Environmental Network
Women's Food and Farming Union
World Cancer Research Fund

OBSERVERS

British Dietetic Association
Chartered Institute of Environmental Health
Christian Aid
Consumers' Association
Faculty of Public Health Medicine of the Royal College of Physicians
Farmers' World
Farming and Wildlife Advisory Group
Health Education Authority
Intermediate Technology Development Group
Institute of Food Research
Institute of Trading Standards Administration
National Consumer Council
National Heart Forum

OBSERVERS

Royal Society of Health
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Sustain

the alliance for better food and farming

Our work
To represent around 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 the equity and enrichment of society and culture.

Food Facts No 7

Bitter harvest, bitter beer

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