

Carrot fashion

A look at the environmental and social aspects of carrot production.

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Series editor: Tim Lobstein

Food Facts No 6



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Public concern about the quality of the food we eat in the UK is demonstrated by increased fears about unsafe food (a recent poll¹ showed a majority now believe food safety is deteriorating) along with a growing interest in healthier eating and rising sales of organically-produced foods.

There is also concern about the environment and farming practices, and how our food production and distribution systems may be contributing to problems such as transport pollution, global warming and loss of wildlife.

This report is one of a series intended to provide information about the negative and positive impacts of food production methods on our environment and society.

SAFE Food Facts are sign-posting documents, indicating the current scope of the issues and sources of further information. SAFE Alliance members and observer organisations are additional sources of such information and their contact details can be found inside the back cover.

This is the sixth report in the series, focusing on carrot production. It has been produced with funding from the Government's Environmental Action Fund, the Esmée Fairbairn Charitable Trust, the Cobb Charity, the Cecil Pilkington Charitable Trust and the Chapman Charitable Trust.

The views expressed do not necessarily represent those of every member of the SAFE Alliance.

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Carrot fashion

Carrots come second only to potatoes as Britain's most popular fresh vegetable. We buy around half a kilogram of fresh carrots per person per month, easily outstripping our purchases of onions, cabbage or fresh tomatoes.

Almost all of the carrots we buy are grown in the UK, and farmers have seen a notable rise in the amounts they have been taking to market -- up a quarter in the last decade alone. The amount of space devoted to carrot growing in the UK has remained remarkably static, due largely to an extraordinary increase in yields which now allow farmers to produce, on average, over five kilograms of carrots from a single square metre of land.

Such high production levels depend on selecting heavy-cropping varieties that respond well to fertilizers and that can resist pests with the help of an array of chemical pesticides. Producers are under pressure from retailers to keep their costs low, while some supermarkets add a high margin to the price.

This report looks at the environmental and social aspects of this form of carrot production, and the alternatives that are available.

The nutritious root

Seeds found in excavations of Swiss lake villages at Robenhausen indicate that the cultivation of carrots may have begun 2000-3000 years ago.² The long storage life of carrots, and their nutritional value, would have been as useful in early civilisations as they are today.

The early carrots were not the orange ones we now grow. Our carrots come from purple carrots grown in Afghanistan in the 7th century AD crossed with yellow types which were grown in Syria in the 9th or 10th century. These purple and yellow seeds came to Western Europe via East Africa with the Moors. Like spinach and aubergines, they were grown in Spain, then Holland and France, and then brought to England, perhaps with Protestant Flemings who came over from the Netherlands during the reign of Elizabeth I and started growing carrots in Kent and Suffolk.³

Carrots only became a common standby in Europe in the nineteenth century. Before that they were viewed as exotic. In the Stuart Court for example, ladies pinned the feathery plumages of young carrots to their hair or onto their hats.⁴

Like other new vegetables, when they were introduced to England carrots were considered suitable for both savoury and sweet dishes. Recipes included English carrot pudding and Angel's Hair Charlotte (Charlotte aux cheveux d'ange), in which carrots, sugar and lemon are cooked to a jammy consistency, mixed with cream and almonds and folded into a mould of biscuits dipped in orange juice, and chilled.

A health food

Carrots make an excellent contribution to a healthy diet. They are a good source of carotene, from which our body makes vitamin A, along with useful amounts of other vitamins including vitamin C. They have virtually no fat, and are rich in dietary fibre.

Government advice is that we should increase fruit and vegetable consumption, while cutting back on saturated fats, salt and sugars. UK consumers eat less fruit and vegetables than those in other European Union countries, with an average consumption of 2.5 portions a day -- half of the recommended amount.⁵

Perhaps in response to the healthy eating messages of the last few years, the average person's consumption has been gradually rising over the last few years, reaching current levels of 113 grams per week, equivalent to nearly half a kilogram per month.

Our rising purchases of fresh carrots

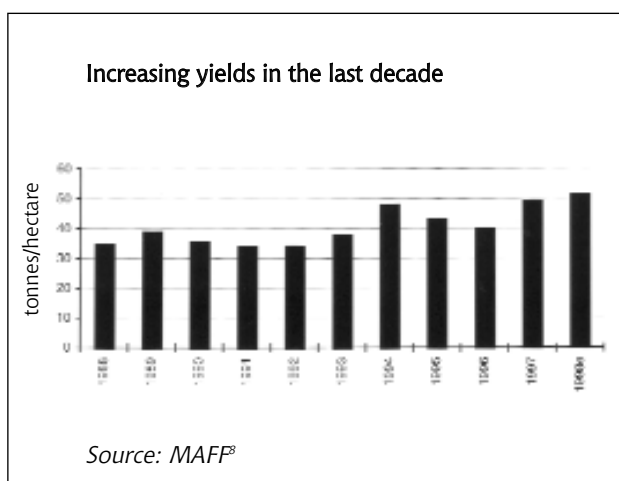
grams/person/week

1982	88
1987	105
1992	111
1996	113

Source: MAFF⁶

Homegrown produce

UK production of conventional carrots has steadily increased in the last ten years, making a rising percentage of the total quantity purchased, now close to 100 per cent.⁷ Although the area planted in the UK has slightly decreased, the marketed yield per hectare has been increasing, suggesting intensification of production. (More production figures are given in Table 1 in the appendix.)



Most of the carrots we eat come from East Anglia (the counties of Essex, Norfolk and Suffolk) where over 40% of the carrots grown in England and Wales originate.⁹ A further 20-30% come from Lincolnshire and Nottinghamshire.

In Vichy, carrots were incorporated into cures for overloaded digestions (eaten daily). Carrots were also taken for dropsy (oedema), or cooked and pickled in vinegar to reduce a swollen spleen.



The Ministry of Food encouraged the eating of carrots for RAF pilots flying night raids during the Second World War.

The pesticide problem

Carrot crops are hosts for insect populations, which in turn provide food for birds and other wildlife. However, these insects, the carrot root fly in particular, can damage the crops, and most farmers use pesticides to reduce their losses. Pesticide use on carrots has led to concern about residues in our food as well as damage to the environment.

Concern peaked in 1995 when the Ministry of Agriculture, Fisheries and Food reported that unexpectedly high residues of organophosphate (OP) insecticide were found in some carrots. A change in sampling techniques, in which carrots were analysed on an individual basis rather than in bulked samples, revealed that residue levels varied considerably from carrot to carrot and that up to 2 per cent of carrots contained organophosphate residues as high as 25 times above the average level.

The Advisory Committee on Pesticides (ACP), which advises government ministers, considered as a result that 'margins of safety have been eroded to a level where action is required to restore them'.¹⁰ The Acceptable Daily Intake (ADI) which is normally used to assess risk to consumers, was exceeded by up to three times in about half of the carrots tested.

For consumers, the advice was to peel and top carrots before eating.¹¹ Cutting off the top 2-3 mm and peeling the carrots removed about four-fifths of the residues of the OPs chlorfenvinphos, primiphos-methyl, quinalphos and triazophos. A further organophosphate of concern was phorate, which is systemic, which means that residues can be found throughout the root and cannot be removed by peeling.

The main solution proposed by the ACP and accepted by the then Minister was to restrict growers to three applications of organophosphates per year,¹² down from a maximum of nine.¹³ It was not clear whether the recommended reduction in applications would continue to produce individual carrots with occasionally high residues¹⁴ and subsequent government testing of carrots confirms that organophosphate residues are still occurring in 94 per cent of samples from UK-grown crops known to have received organophosphate treatment, even though the carrots had been washed before sampling.¹⁵ Tests of imported carrots found organophosphate residues in nine per cent of samples.¹⁶

Following continuing concerns about the erosion of safety margins, in December 1997 approvals for use of phorate on carrots and parsnips were withdrawn.¹⁷

Health risks associated with pesticides are not just for consumers eating the residues. The health of farm workers applying pesticides must also be considered, particularly with reference to organophosphates which may have adverse neurological effects, both short and long term.

Pesticide use has effects on wildlife, too. In many cases these are a result of the reduction in insect populations leading to a reduction in the available food for other animals. There have also been some cases of more direct poisoning of wildlife following pesticide treatment of carrot crops. In 1996 the Advisory Committee on Pesticides noted that the death of two Marsh Harriers in England followed the approved treatment of carrots with phorate, and that the residues detected in the dead birds may have been due to eating earthworms or other invertebrates which had been poisoned by the pesticide. Further incidents of this route of exposure have been reported from the UK and other countries.¹⁸

Another incident also implicating pesticides used on carrot crops resulted in the death of four red-legged and two grey partridges in a field where carrot seed had been drilled with granules of the pesticide aldicarb. Residues of this compound were detected in the birds and it is thought that they had been poisoned after using the granules as grit.¹⁹

Pesticide-free carrot production

Organically produced carrots are grown without any input of pesticides or chemical fertilizers. Crop rotations and enhancement of biodiversity are used in organic systems to combat pests or diseases. These techniques can also help to build good soil structure and fertility, ensuring good crop growth.

Major carrot pests, such as the carrot root fly, can also be avoided by careful timing of the sowing of the crop. The main egg-laying periods of the carrot root fly are April-May (first generation) and July-September (second generation). If the first generation can be avoided then it should be possible to avoid a second, and in some areas a third, generation. Fleeces can be used as a barrier, especially in July, for winter crops (see advice for organic gardeners below).

A break of at least 4 years is left between organic carrot crops on a particular site in order to break pest and disease life cycles and thus prevent problems building up. Different carrot varieties can also be chosen which will spread the harvest over a longer period and also increase diversity and therefore stability in the system. Main crop carrots are planted in May (or slightly later to avoid carrot root fly) and harvested around October-November. Light, well-drained soils are optimal for production.

Weeding can be a problem in organic carrot production. Flame weeding techniques can be very effective at overcoming early weed competition with the crop. Timing of this activity is very important as it needs to be done just before the carrots emerge. Mechanical weeding can be used to clear between rows of carrots and hand weeding is carried out in between the carrots in the row. Crop planting in succession also helps to manage the task.

Demand for organic carrots outstrips supply

Despite the climate in the UK being very suitable for carrot production, we are still relying on foreign imports to boost organic supplies. This is mainly because the demand for organic carrots, as for other fresh organic produce, far exceeds the UK supply.

Growing consumer demand for organic produce has led to considerable expansion in UK organic production over the last few years. There is currently more land in conversion than fully organic, and this rapid rate of expansion is expected to continue. UK organic carrot production (1600 tonnes in 1997) therefore looks set to increase considerably.

Advice for organic gardeners to avoid carrot root fly

Grow carrots under a crop cover. Spread horticultural fleece, a lightweight, spun polyester material, over the ground where carrots have been sown. It can be held down with soil, proprietary pegs, bricks or plastic bags full of sand or soil. It should cover the plot, allowing at least 30cm (1ft) around the edges. Enviromesh is a fine mesh plastic, longer-lasting than fleece, which can be used in a similar way. Both covers will allow air, water and light to reach the carrots, but you will need to weed as usual, and check regularly to make sure that other pests, such as slugs, are not devouring your crop.

Carrot flies are low-flying insects. A barrier of polythene or clear plastic 75cm (30in) high around a plot of carrots can give considerable protection. It should be erected as soon as the carrots are sown, and secured with four sturdy corner posts.

Delay sowing until early June.

Choose a windswept site as the carrot fly is not a strong flier and spends a lot of time in sheltered field or garden margins.

Grow the variety Flyaway, which is resistant to carrot fly. It doesn't completely escape damage, but its roots contain reduced levels of chlorogenic acid, which the larvae need for survival.

Source: Henry Doubleday Research Association

The colour of carrots is influenced by soil temperature, as is the root shape. Good colour requires warm soil. The maximum colour develops at 16-21 °C. If you grow carrots in containers, paint the containers black to improve colour.

Case study: Organic carrots marketed directly to local people in Dorset

Hugh and Patsy Chapman grow carrots on their organic 9.5 acre holding, Longmeadow, in Godmanstone, near Dorchester in Dorset. Carrots are one of 30 crops which they sell through their farm shop and box scheme. The box scheme has 130 members who receive a weekly box of fresh produce in season. Almost all of their produce is marketed directly through these outlets, although they also supply other box schemes and a local wholefood shop.

Carrots are one of the most popular of the organic vegetables for sale and about half an acre is used for carrot growing. They are sold unwashed with the soil still on them. Carrots sold this way keep better than those which have been washed, as the process of scrubbing can damage their skin and reduce their storage life. As the carrots are organically produced, Hugh and Patsy's customers can just wash the dirt off their carrots and eat them unpeeled.

The Chapmans have tried growing several different carrot varieties and have now settled with Nairobi, an early maincrop and the UK's most widely grown carrot. They believe that the main factors in determining the flavour of the carrots is the way in which they are grown and the soil in which they are planted, although the weather also has an effect and the intensity of flavour varies from year to year. Carrots do best in light soils and the flinty soil at Longmeadow seems very suitable. The Longmeadow holding employs Hugh and Patsy full time as well as part-time workers equivalent to another full time post.

Since the Chapmans started to farm their land about eleven years ago they have diversified the habitat on the holding, planting hedges and trees as well as an orchard, and they have found a notable increase in wildlife, including bird species such as blackbirds and thrushes.

Selecting local carrots at Longmeadow farm shop



Photo: Kate Best

Carrots on the road

Increasingly centralised production of distribution systems for food has led to increases in road freight of food, and carrots form part of this trend.

Most carrots are sold through the major supermarkets. The major retail chains have around 76 per cent of the market share for fresh produce and 63 per cent of shoppers buy their fruit and vegetables from supermarkets.²⁰

Carrots, like other food, are travelling nearly 60 per cent further on the UK roads than in the 1970s (see table 2 in the Appendix).

Direct sales from the producer to the consumer are one way of reducing the distance food travels, of increasing the likelihood that it is really fresh, and of creating a dialogue between farmers and consumers about the farming of our countryside.

Schemes which have been established to create better local food availability include food box schemes, farm shops, food co-operatives and farmers' markets. (See Local food section below.)

Counting the cost

While the major supermarkets have more purchasing power and buy carrots at a lower price than other retailers, recent research by SAFE into prices shows that these savings are not passed on to the customer. Despite the economies of scale that benefit the major retailers, the prices of carrots were very similar in street markets and greengrocers. Furthermore, the cheapest carrots in a supermarket were a similar price to the street market's cheapest carrots but could only be bought in large volumes, and were prepacked, further restricting choice.

The smaller retailers can often provide more local produce. While the supermarkets identified their carrots as British or Scottish, the market stall holders and greengrocers in Cambridge were selling locally produced carrots and were often able to identify the grower. No locally-grown organic carrots were on sale — all the organic carrots were from overseas.

Organic carrots were only available at one of the three supermarkets visited and they were more expensive than in the independent wholefood stores.

They were also in prepacked bags of 500g, which may not suit the needs of single and low-income shoppers.



Photo: Rosemary Hoskins

Survey of choice and price of carrots

Excludes baby and ready-cut carrots

The price growers were getting for non-organic carrots in the wholesale market and auction was between 12 pence and 14.5 pence per pound. Organic carrots were all imported.

Retailer	Carrots available	pence per lb	notes
Market stalls, Market Square	Local (Suffolk) loose	18	30p for 2lb
Sainsbury's, Sidney St	Scottish class I loose	18	
Sainsbury's, Sidney St	Economy British prepacked	14.6	must buy 4.4lb
Sainsbury's, Sidney St	Italian/Spanish organic prepacked	80.8	must buy 500g
Marks & Spencer, Market Square	British class I prepacked	45	must buy 2.2lb
Marks & Spencer, Market Square	Scottish Angus class I prepacked 450g	59	
Greengrocer 1, Chesterton Road	British loose or in net bag	18	
Greengrocer 2, Chesterton Road	Local loose	25	
Co-operative CRS, Chesterton Road	British class I loose	23	
Arjuna Wholefoods, Mill Road	Dutch organic unwashed loose	57	
Arjuna Wholefoods, Mill Road	Spanish/Israeli organic washed loose	78	
Farmer Giles, Mill Road	French organic	55	

Source: SAFE Alliance, survey undertaken Cambridge, 22 March 1999

Carrots and jobs

Over the last fifty years, thousands of jobs have been lost in farming and the UK now has the lowest farm employment in Europe, with direct employment in agriculture at two per cent of the population (compared to the European average of 5.5 per cent).²⁵ Rural jobs continue to be lost as a result of increased farm mechanisation and market specialisation.

Horticulture is relatively employment-intensive, employing about 15 per cent of full time workers in farming and 21 per cent of part time workers,²⁶ even though horticulture occupies less than one per cent of Britain's farmland (see Table 3 in the Appendix). Horticulture benefits less from the Common Agriculture Policy than other sectors such as arable farming and the production of milk and meat (see Table 4 in the Appendix).

As the case studies in this report illustrate, horticulture such as carrot production does create rural employment opportunities. Longmeadow, the organic holding in Dorset described on page 4, has the equivalent of three full time posts on 9.5 acres. Two surveys, covering 800 organic farms, found an

increase in labour use on organic farms after conversion, often related to new activities such as processing and direct sales.²⁷

The Knights' Farms of 11,000 acres in Norfolk (page 7) provide employment for about 600 people, mostly in the packhouse on the farm, processing and packaging the vegetables. Local processing, packaging, marketing and retailing of horticultural produce can all add value and keep more of the profits in the local community.

Varieties

Although we usually buy carrots without knowing their variety names, there are several varieties grown in the UK (see below).

Early, maincrop and late varieties extend the growing season. There are four main types of carrot: Autumn King, Nantes, Chantenay, and Berlicum. Within these types there are many varieties. The Chantenay type was developed for canning and is a short carrot which can be tinned and eaten whole.

Carrot varieties from the Henry Doubleday Research Association's Organic Gardening Catalogue 1999

Early varieties

Amsterdam Forcing The earliest variety for forcing in the spring. Small cylindrical roots, excellent for freezing.

Nantes Tip Top An early variety. Almost coreless and good for pulling early and eating young. Can be sown from February maturing from June onwards. Can be sown as late as August.

Parabel Small sweet-flavoured spherical roots for eating whole.

Early maincrop

Chantenay Red-Cored High-yielding early maincrop with short wedge-shaped roots. Rich deep orange colour throughout. Quick growing and best sown when the soil is warm.

Feria Ideal for slicing since the roots are long and of good cylindrical shape, with outstanding internal and external colouring. Early maturing and very uniform.

Fly Away Bred for carrot fly resistance. It contains reduced levels of chlorogenic acid, which the larvae need for survival. Medium sized cylindrical roots are smooth skinned with a sweet flavour. Especially crisp and tasty when raw.

Magno Very vigorous with excellent root colour. Later than Feria and stores well.

James Scarlet Intermediate A very popular maincrop carrot with long tapering roots which can be pulled young or lifted in October for winter storage.

Long Red Surrey Long slender roots, orange with a distinctive yellow core. Good drought resistance on sandy soils. Exceptional flavour.

Newmarket A good quality uniform Nantes hybrid with smooth skin and well above average yields. Good resistance to splitting and noted for its flavour in trials at Ryton Gardens.

Redca A Chantenay type, stump rooted and very uniform. Excellent root colour with a nice smooth skin.

Late maincrop

Autumn King Large uniform roots of exceptional colour and good for overwinter storage. retains colour and flavour well. Heavy cropping and highly popular.

Berlicum A high quality maincrop with long cylindrical stump roots of excellent colour and texture. In good soil it produces uniform carrots 17-20cm long.

Karotan Large pointed deep orange roots with excellent internal quality. The high carotene, sugar and dry matter content have made this a favourite for the processing industry. Its late maturity and root depth make it very resistant to frost damage. Good sweet taste.

St Valery (1885) extremely long tapering roots make this ideal for exhibiting in your local horticultural show.

Local food: linking producers and consumers

Local food schemes are often established by people trying to get better food more cheaply or to help improve access to nutritious food in areas which can be regarded as food 'deserts'.

Farmers looking to improve the percentage of the food sales price which they receive have moved into direct marketing through box schemes, farm shops and farmers' markets. In some cases people get together to grow their own food.²¹

Box schemes usually involve a commitment from members of the scheme to purchase regularly. Produce may come from a farmer — often organic — or from a community garden. Because the food is usually local and seasonal, the contents of the weekly box delivered to members are often a surprise. .

Green Adventure is a box scheme providing organic fruit and vegetables, bread and eggs to black and minority ethnic groups and people on a low income in South London. Membership is on a sliding scale to allow participation by people on low incomes. Food is grown by the project and delivered locally by bicycle and trailer.

Source: NFA²²

Farmers' markets are growing in popularity around the UK. The principle underlying these markets is that food is sold directly to the public by local farmers or members of their family. The fact that consumers can talk directly to the people who have produced the food increases communication and understanding. Farmers' markets help to reduce food miles and transport pollution. The markets also allow farmers to increase the proportion of the sales price they earn and to build up customer loyalty.

Farmers' markets were established in Bath and Bristol in 1997 and 1998 and have been followed by around 15 more markets. The establishment of farmers' markets has been strongest in the south-west, but farmers' markets are planned for 1999 in around 35 locations throughout the country.²³

Food co-operatives and **community buying groups** are membership organisations buying food in bulk in order to purchase healthier, better quality foods at lower prices than they are sold in shops. Fruit and vegetables usually offer the greatest savings and although some groups may buy from wholesalers, others take advantage of the economy of group purchasing to buy wholefoods or to buy fresh organic produce directly from local farmers.

Bath Local Organic Buyers buy produce from local producers. Members collect their food from a neighbourhood drop-off point, usually somebody's home, and order from a list of what will be available the following week.

Source: Soil Association²⁴

Carrots on sale at Bristol farmers' market



Photo: Chris Gittins

Appendix

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997e
Home production marketed (thousand tonnes)	472.1	494.2	503.2	485.7	543.9	608.2	591.4	632.7	517.2	617.4	625.3
imports (thousand tonnes))	44.1	43.7	40	35.2	49.1	34.3	29.2	32.4	43	52.6	27.9
exports (thousand tonnes))	2.9	3.5	7	5.2	7.9	8.3	29.5	20.7	29.6	18.6	26.4
HPM as % of total supply	92	92.5	93.8	94.2	93	95.9	100.1	98.2	97.5	94.8	99.8
Year	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98e
marketed yield (tonnes per hectare)	34.9	39.3	35.9	34.4	34.5	38	48.4	43.5	40.4	49.3	51.7
planted area in the UK (hectares)	12778	14028	13789	14301	15552	13980	12486	13033	13115	13629	11485

Source: MAFF²⁰ (e=estimate)

	Quantity (millions of tonnes)	Average distance (kilometres)
1975	266	76
1980	257	94
1985	268	95
1990	299	110
1995	308	122
1997	342	119

	£million for 1997/98
Cereals	911
Beef and veal (BSE)	825
Beef and veal (non-BSE)	522
Sheep	288
Oilseed and linseed	240
Milk/milk products	211
Sugar	110
Set-aside	92
Horticulture	0

	Thousand hectares
Crops	4,989
Of which	
Wheat	2,036
Barley	1,358
Other cereals	120
Oilseed rape	446
Sugar beet	196
Fodder beans	197
Potatoes	166
Open field vegetables	126
Orchard fruit	30
Soft fruit	11
All other crops	299
Set aside	307
Grass under 5 years old	1,393
Traditional grass	5,241
Rough grazing	5,595
Total	17,525



The Sustainable Agriculture, Food and Environment Alliance exists to unite farmer, environmental, consumer, animal welfare and developmental organisations. We seek forms of food production which are beneficial to the environment, sensitive to the need for global equity, and which produce safe and healthy food in a manner supportive of rural life and culture.

The SAFE Alliance is joining with the National Food Alliance to become

Sustain

The alliance for better food and farming.