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The Agricultural Revolution

Cows and Plows

The most significant development in eighteenth-century England that relates to the present enquiry was the Agricultural Revolution. The resulting changes in farming practices impacted on crop production, the biological characteristics of domesticated animals and eventually on human eating habits. These warrant consideration in some detail, with emphasis on the changes in animal husbandry. In medieval times, as in many developing countries today, sheep and cattle grazed on communal grasslands left in their natural state. As the lands were held jointly there was very little attempt either to avoid overgrazing or to effect improvements, for example by appropriate drainage.¹ Cows were also allowed to roam untended in the forests, then much more extensive than now. Pigs were left to forage in the woods, feeding for the most part on acorns and beech masts. Deer roamed in the woodlands and subsisted on branches of trees and shrubs. Poultry scratched the ground in the farmyards, such as they were, subsisting on whatever seeds or scraps they could find.

There was no attempt at selective breeding, which would have been impossible anyway in the absence of any fencing and with the stock of the entire community mingling together. Unsupervised and free to roam, cattle, sheep and pigs were not fastidious in choice of sexual partners with the resulting “promiscuous unions of nobody’s son with everybody’s daughter”.² The animals were almost invariably stunted and underweight (Illustrations 1 and 2). Rams were described as having skin that rattled on the ribs. The milk yield of cows was both low and erratic. The arable lands were cultivated in accordance with the strip system. This ensured that allocations between better and poorer land was fair, but compelled each individual to waste much time walking between his isolated allotments, which were usually dispersed widely. Much land was wasted in order to keep the strips clearly separated. The good farmer could not maintain his lands free of weeds if his neighbour was neglectful in this respect. Attempts at improving the land such as by better drainage was frustrated by need for general agreement and the sequence of crop rotation did not allow for individual variation. With its innate inefficiencies, the strip system could barely supply enough for human consumption and little or none was available for winter feeding of the animals.³ Stock with breeding potential could be maintained, although with difficulty, over the winter, but because of limited availability of feed,

¹ R E Prothero, *The pioneers and progress of English farming*, London, Longmans Green, 1888, p. 6.

² *Ibid.*, p. 50.

³ Lord Ernle, *The land and its people: chapters in rural life and history*, London, Hutchinson, 1925, pp. 5, 9, 10.

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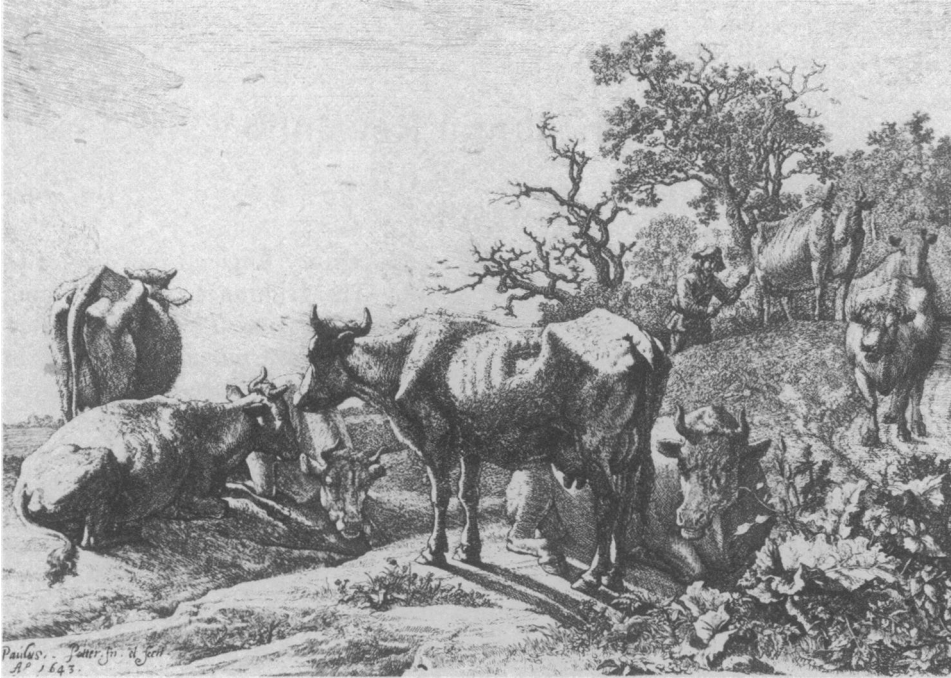


Illustration 1: Cattle roaming on common land. Etching by P Potter, 1643. (Wellcome Library, London.)

most other animals had to be killed in the autumn.⁴ The meat was then salted as no other methods of preservation were available. The supply of meat, even if considered edible when tainted, would rarely last until the spring, and the availability of milk in winter was very limited.

Improvements in agricultural practices in association with the enclosure movement had their beginnings late in the medieval period and continued at a very slow pace in Tudor times.⁵ The changes involved replacing widely separated strips of land by consolidated fields of equivalent area with each individual receiving an additional allotment equal to his share of the common and waste lands.⁶ The newly allocated fields were enclosed with walls or hedges and the owners had the right to farm their consolidated lands in accordance with their own personal wishes, resources and abilities.⁷ The enclosure movement continued piecemeal in the Stuart era⁸ but became dramatically more rapid during Georgian times when the need for unanimous agreement to the changes was circumvented by introduction of private bills submitted

⁴ *Ibid.*, p. 6.

⁵ Prothero, *op. cit.*, note 1 above, p. 65.

⁶ *Ibid.*, p. 18.

⁷ *Ibid.*, p. 19.

⁸ Joan Thirsk, 'Agricultural policy: public debate and legislation', in Joan Thirsk (ed.), *The agrarian history of England and Wales, Volume V: 1640–1750. II. Agrarian change*, Cambridge University Press, 1985, p. 379.

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Illustration 2: A calf grazing on public lands. Barbados (photograph: L Michaels).

to parliament. There were eight Enclosure Acts passed during the years 1724 to 1729 and thirty-nine during both the 1740s and 1750s,⁹ but a subsequent surge followed so that by the end of the century the total exceeded 2,000.¹⁰ The status of over five million acres was changed in this way, but the total acreage affected was considerably greater as much land was enclosed by mutual agreement and without recourse to sanction by Acts of Parliament.¹¹ Although often causing considerable and perhaps avoidable suffering to the small farmer, the overall effect on agricultural output was dramatic. The efficiency of the landholder or the farm labourer was increased because the new consolidated fields were far more compact than the old strips. Time was no longer spent walking between dispersed landholdings and the unused land that had formerly separated the many individual holdings was brought into cultivation. Protection of crops from uncontrolled grazing became possible. By separating the animals of individual farmers, enclosures had the potential for limiting the spread of epizootic diseases and providing an assured supply of manure. Long and secure leases or outright ownership provided motivation for improvement of the land, both for the raising of crops and for animal husbandry.

During the early eighteenth century the pace of change was rapid. The nobility

⁹ *Ibid.*, pp. 380–2.

¹⁰ Frank O’Gorman, *The long eighteenth century: British political and social history 1688–1832*, London, Arnold, 1997, p. 122.

¹¹ Thirsk, *op. cit.*, note 8 above, p. 379.

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and gentry, although despising income earned through trade, were not averse to increasing the income from their estates and they were in the forefront when it came to developing new agricultural techniques. Viscount Townshend propagated a system of crop rotation that included clover, silage and root crops, notably turnips, thereby earning himself the sobriquet “Turnip Townshend”.¹² As a result of his innovations, it was no longer necessary to leave fields fallow. Henceforth they could be cultivated every year. Rye and other “artificial” grasses were introduced, fields were manured intensively, marled regularly and overgrazing reduced. Iron ploughs and harrows were brought into use and Jethro Tull advanced the use of drills for sowing. As a result it was possible to cut deep furrows and implant seeds directly into the soil at predetermined intervals, thereby eliminating the wastage associated with the previous practice of broadcasting the seed.¹³ Horses, notably Clydesdales, replaced oxen, and with their greater strength and speed they were more effective when pulling the newly developed implements.¹⁴ Drainage systems were introduced and increasingly well maintained.¹⁵ While all of these changes resulted in greater productivity per acre, marginal and waste lands were brought into use and some of the forests cleared so that the area under cultivation in England increased by some two million acres between 1696 and 1797.

As a result of these changes, crushed rapeseed residues, cattle cake, oil cake, crushed oats, clover and cabbage became available as cattle feed, and sheep were given turnips, oil cake made from clover, vetches and mustard to supplement their grazing.¹⁶ Deer were domesticated by being kept in parks, often under licence, and given supplemental feeds of grain. Hogs were fattened with brewers’ grain, beans and pulses, and also from the increasingly available buttermilk and curds.¹⁷ Poultry were kept in enclosed farmyards or coops and fed grain in regular and adequate amounts. The supply of animal feed became not only more assured but also more varied and plentiful. Its abundance, and the housing of cows in stalls and sheep in folds, meant that they could be kept in better health in summer and alive and well nourished over the winter. In consequence meat became available throughout the year. Manure produced in winter in stalls or folds could be used as a supplementary fertilizer for application to summer grazing lands.

The exemplars of improved farming practice were frequently prominent in society. The first three Hanoverian kings were greatly interested in agriculture, George III taking great delight in being known to his subjects as “Farmer George”.¹⁸ An example of improved management of estates was set by Sir Robert Walpole, First Lord of the Treasury and *de facto* Prime Minister for twenty-one years. He was reported to

¹² Prothero, *op. cit.*, note 1 above, pp. 44–7.

¹³ *Ibid.*, p. 47.

¹⁴ Jonathan Brown and H A Beecham, ‘Farming techniques’, in G E Mingay (ed.), *The agrarian history of England and Wales, Volume VI: 1750–1850*, Cambridge University Press, 1989, p. 289.

¹⁵ Prothero, *op. cit.*, note 1 above, p. 43.

¹⁶ *Ibid.*, p. 33.

¹⁷ Peter J Bowden, ‘Agricultural prices, wages, farm profits and rents’, in Joan Thirsk (ed.), *The agrarian history of England and Wales, Volume V: 1640–1750. II. Agrarian change*, Cambridge University Press, 1985, p. 32.

¹⁸ Prothero, *op. cit.*, note 1 above, p. 79.

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have given attention to his stewards' reports on the state of his farmlands priority over the contents of government dispatch boxes.¹⁹ Turnip Townshend, whose innovations have already been described, had been Lord Privy Seal and played an important part in the negotiations that led to the 1707 Union of England and Scotland. He had also served as Secretary of State for Foreign Affairs during the War of the Spanish Succession. Thomas Coke of Norfolk, who set an example in consolidating his 43,000 acre estate and applying the new farming techniques, was a descendant of one of England's most famous Lords Chief Justice and eventually became Earl of Leicester. When it came to making improvements in farming methods, the gentry as well as members of the nobility were in the forefront. Eighteenth-century English society was very class-conscious. The small-scale farmer respected and looked up to his "betters" and at the same time sought to emulate them. Large-scale landowners, such as Coke of Norfolk, often made renewal of the leases of their tenants dependent on good farming practice and increases in rents made raising agricultural productivity a necessity for survival on the land.²⁰ Establishment of farming societies and regular agricultural shows facilitated wide dissemination of the new knowledge. This all helped to overcome inertia and any resistance to change so that the new methods became widely adopted by small as well as large-scale farmers.

Animals were bred selectively to some extent by the early 1700s and this practice continued on an increasing scale as the century advanced, largely under the influence of Robert Bakewell. The enclosures had made it possible to hedge or fence pastures to which farm animals could be confined and this made selective breeding feasible for the first time. Bakewell's methods included crossing breeds with different characteristics and then selectively mating animals with qualities considered desirable, to the total exclusion of strains judged to be inferior.²¹

Selective breeding was motivated almost exclusively by the desire to increase the mature weight of cows, sheep and pigs and the speed with which this could be attained. These considerations took precedence over all others. "Size was the only criterion of merit".²² As horses replaced oxen at the plough, the need to strengthen cattle as draught animals diminished. Regard for appearance lessened and features such as colouring and horn structure ceased to be matters of concern. Hardihood when driven became less important as improved road surfaces made for easier movement (see pages 140–1). Often driven in early life from the Midlands and beyond to the vicinity of London, they were then fattened close to their place of ultimate slaughter by farmers who specialized in managing feed lots for this purpose. The untoward weight loss with lengthy road transfer before killing was thereby avoided.²³ Docility became less important once animals were kept in enclosed fields in summer and in stalls in winter. When selectively breeding sheep, quality of fleece

¹⁹ *Ibid.*, p. 18.

²⁰ R A C Parker, 'Coke of Norfolk and the agrarian revolution', *Econ Hist Rev.*, 2nd series, 1955–6, 8: 156–66, pp. 157, 159.

²¹ Prothero, *op. cit.*, note 1 above, p. 51.

²² G E Fussell, 'The size of English cattle in the eighteenth century', *Agric Hist*, 1929, 3: 160–81, p. 163.

²³ Brown and Beecham, *op. cit.*, note 14 above, p. 247.

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Table IV.1
Average weight of animals sold at Smithfield (lbs)

Year	Beeves	Calves	Year	Sheep	Lambs
1710	370	50	1710	28	18
1785	800	148	1790	80	50

Sources: G E Fussell, 'The size of English cattle in the eighteenth century', *Agric Hist*, 1929, 3: 160–81, pp. 160–1; G E Fussell and Constance Goodman, 'Eighteenth century estimates of British sheep and wool production', *Agric Hist*, 1930, 4: 131–51, p. 134.

and quantity of wool were subordinated to amount and speed of weight gain. Wool became relatively less important commercially after 1614 when its export was banned in order to reduce Continental competition with the English clothing industry. Meanwhile, improved techniques of processing wool made length and fineness of fibre less important.

The new breeding, feeding and management techniques produced generations of farm animals that could mature at earlier ages, gaining weight extremely rapidly and, by modern standards, to excess. There was close to a threefold increase in weight in cows and calves, sheep and lambs sold in Smithfield (London's central meat market) during the eighteenth century (Table IV.1).²⁴ As there was no recorded tendency for the age at which lambs and calves were sold to change during this time, their greater weights at slaughter as the century progressed can be explained by a faster rate at which they could be fattened before reaching maturity.

The increasing weight of adult cattle sold at Smithfield was part of a general tendency for them to become heavier throughout England during the course of the eighteenth century. Records for its earlier years are rather scanty, but become more plentiful later, the changes being documented to a greater extent and county by county by interested individuals, notably Arthur Young, and later by a newly constituted, government-sponsored Board of Agriculture, of which he was one of the originators.²⁵ James Thorold Rogers reported that at the beginning of the century the average weight of oxen was about 400 lbs after evisceration and removal of the head, the figure agreeing reasonably well with Gregory King's 1696 estimate of 370 lbs.²⁶ By 1770, Arthur Young was reporting cows of 700 lbs and oxen of 1,120 to 1,400 lbs. Later he listed shorthorn and Devon cattle with weights ranging from 840 to 1,120 lbs and 1,400 lbs respectively.²⁷ George Fussell documented English cattle weights during the years 1786–96. Hereford, Devon, long- and shorthorns ranged

²⁴ Fussell, *op. cit.*, note 22 above, pp. 160–1; G E Fussell and Constance Goodman, 'Eighteenth century estimates of British sheep and wool production', *Agric Hist*, 1930, 4: 131–51, p. 134.

²⁵ Arthur Young, *The farmers' tour through the north of England or the northern tour*, vols 1–4, London, W Strachan, 1770, p. 151.

²⁶ James E Thorold Rogers, *Six centuries of work and wages: the history of English labour*, London, Swan Sonnenschein, 1909, p. 77 fn; Gregory King, *Natural and political observations and conclusions upon the state and condition of England 1696*, ed. George E Barnett, Baltimore, Johns Hopkins Press, 1936, p. 38.

²⁷ Young, *op. cit.*, note 25 above, vol. 4, p. 190.

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widely, from 420 to 1,568 lbs. The range of weights varied with the breed, longhorns for example being lighter than the others. All, however, were substantially heavier than recorded at the start of the century.²⁸

Limitations of eighteenth-century records of cattle weights apply equally to sheep, but, as was the case with cattle, the increases in weight of sheep sold at Smithfield appear indicative of a growth trend throughout the country. George Fussell and Constance Goodman quoted a 1710 report by Davenant of sheep of 28 lbs.²⁹ By 1774, John Campbell was reporting average weights of 40 to 50 and 64 to 88 lbs for small and large ewes respectively, but 144 to 160 lbs for the largest wethers.³⁰ Fussell and Goodman documented weights of sheep that varied from 40 lbs to as much as 190 lbs during the years between 1790 and 1800. There were variations from breed to breed, with ewes a little lighter than wethers. All were heavier than indicated in records from the beginning of the century.³¹

With all their limitations, the records appear to indicate a very substantial increase in the weight of cattle and sheep during this period. As drawings show (Illustrations 3–4), some of the increase in weight of cattle and sheep could be not only obvious, but even result in appearances that were grotesque. Even allowing for the possibility that exceptionally heavy animals were selected for their portraits, the result on paper reflects a degree of obesity previously unknown. On occasion the animals had difficulty walking because they were so heavy.

Some increase in bone and muscle mass does accompany greater obesity but a rise in the weight of cattle and sheep over only one or two generations meant relatively little increase in lean body mass. Anything more would have been dependent in large measure on genetic factors and would only have become manifest over a longer period of selective breeding. The increase that resulted from feeding in excess of energy requirements would have been predominantly fat, whether interspersed between muscle fibres or stored in depots. These effects of the changes in animal husbandry were demonstrated a century and a half ago in a remarkable investigation conducted by J B Lawes and J H Gilbert, with the help of some highly co-operative farmers. Numbers of mature heifers, bullocks, oxen, sheep, and pigs were separated into two groups. One of each group was slaughtered immediately; the other was fattened by then conventional practices and slaughtered at a later date when the weight eventually stabilized. Carcass weight, and as far as possible the dry weight of the members of each pair were obtained and the fat content estimated after a combination of mechanical expression, melting and extraction with ether. Among the animals kept for later slaughter, there was an average weight gain of between one-quarter and one-half of the weight at pairing (Table IV.2). Fat accounted for about two-thirds of the weight increase. The control animals had been fed in accordance with changes already introduced during the Agricultural Revolution and they were therefore likely to have been heavier than their early eighteenth-century

²⁸ Fussell, *op. cit.*, note 22 above, pp. 170–4.

²⁹ Fussell and Goodman, *op. cit.*, note 24 above, p. 138.

³⁰ John Campbell, *Political survey of Britain*, London, printed by the author, 1774, vol. 2, p. 157.

³¹ Fussell and Goodman, *op. cit.*, note 24 above, p. 138.

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Illustration 3: A fat judge admiring a fat bullock. Etching by James Gillray, c. 1802. (Wellcome Library, London.)

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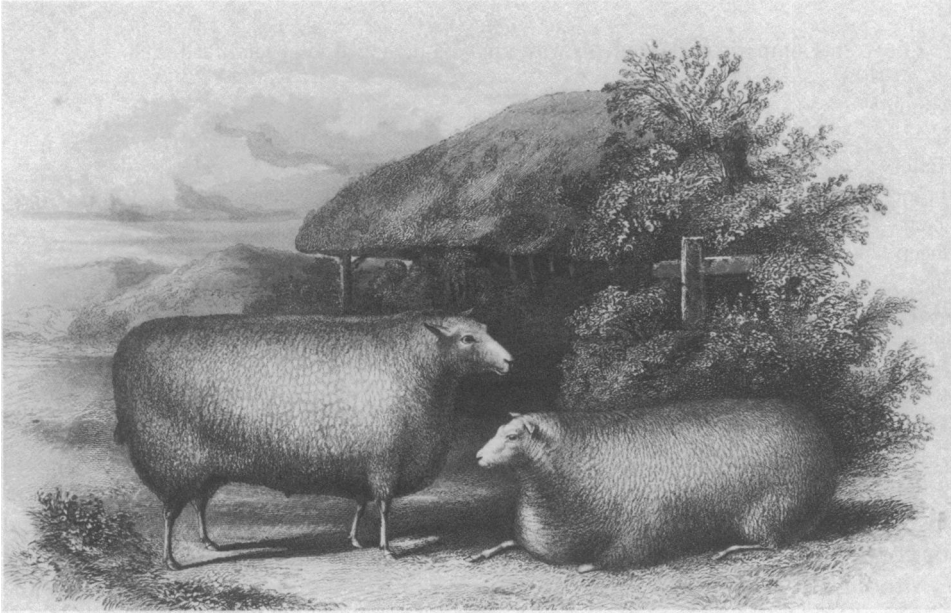


Illustration 4: Two prize winning Leicester rams. Etching by H Beckwith, c. 1849, after H Strafford. (Wellcome Library, London.)



Illustration 5: Award winning Middlesex pigs, bred and fed by Mr Wm Mills Barber of Uxbridge. December 1848. Etching by E Hacker, c. 1848, after H Strafford. (Wellcome Library, London.)

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Table IV.2
Comparison of controls with animals managed in special feed lots

Animal	Number	% Fat Increase
Heifers	12	72.5
Bullocks	86	65.4
Oxen	98	66.2
Sheep	348	70.4
Pigs	80	71.5

Source: J B Lawes and J H Gilbert, 'Experimental inquiry into the composition of some of the animals fed and slaughtered as human food', *Philos Trans Roy Soc*, London, 1859, 149: 493–680, pp. 529, 537.

counterparts. Consequently, the differences between the weights of early eighteenth-century farm animals and the ones selected for special fattening in Lawes and Gilbert's trials probably reflect a much greater difference in fat content than was observed when the authors' control animals were compared with the ones selected for continued fattening.³²

Although in general shortening the time taken to reach maturity, the effect of the new feeding techniques on the weight of pigs varied from breed to breed. While some strains remained fairly constant in weight, others tended to become heavier during the course of the eighteenth century. On the whole pigs respond to increased feeding with rapid weight gain.³³ The overall changes in the average weight of the swine population of England cannot be ascertained readily because to a large extent the animals were raised by individual home owners who kept one or two animals for family consumption. Fat pigs were certainly esteemed at agricultural shows and weights of several hundredweight were recorded not infrequently during the late eighteenth century.³⁴ Mark Overton devised a ratio between the sale prices of pigs and the cost per pound of their meat in order to obtain an indication of the average weight at slaughter of animals raised on a commercial scale. On this basis he calculated an approximately 50 per cent average increase in weight between the 1670s and the 1740s.³⁵ This is much less than the change based on comparison of King's estimate of 46 lbs in 1696³⁶ with Young's records of ranges from 140 to 350 lbs by the 1770s.³⁷ Notwithstanding the wide range of weights, they do suggest a considerable gain in pig weight during the intervening years. Eighteenth-century paintings depicted pigs that were grossly overweight and grotesque in appearance and even if the nineteenth-century examples shown in illustration 5 are exceptional, they certainly reflect a trend.

³² J B Lawes and J H Gilbert, 'Experimental inquiry into the composition of some of the animals fed and slaughtered as human food', *Philos Trans Roy Soc*, London, 1859, 149: 493–680, pp. 529, 537.

³³ Julian Wiseman, *A history of the British pig*, London, Duckworth, 1986, pp. 39–40.

³⁴ Young, *op. cit.*, note 25 above, pp. 178, 189.

³⁵ M Overton, *Agricultural revolution in England: the transformation of the agrarian economy 1500–1850*, Cambridge University Press, 1996, pp. 115–16.

³⁶ King, *op. cit.*, note 26 above, p. 38.

³⁷ Young, *op. cit.*, note 25 above, vol. 2, p. 223.

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Table IV.3
Five-year average cattle and sheep sales at Smithfield (thousands)

Period	Cattle	Sheep
1732–36	81.4	536.0
1737–41	85.4	560.4
1742–46	75.8	529.4
1747–51	70.6	628.8
1752–56	74.0	638.6
1757–61	85.0	599.2
1762–66	83.4	596.6
1767–71	84.0	624.8
1772–76	92.4	620.2
1777–81	98.6	700.2
1782–86	98.4	670.8
1787–91	99.2	706.4
1792–96	116.2	742.6

Abstracted from B R Mitchell, *British historical statistics*, Cambridge University Press, 1988, p. 708.

In 1696 Gregory King reckoned that the cattle population of England was 4,500,000.³⁸ There was a decline during the next eighty years to an estimated 3,500,000 in 1779, the reduction being largely a consequence of outbreaks of cattle plague during the second and fourth decades of the eighteenth century.³⁹ Although the absolute number of cattle was less in 1779 than in 1696, the individual animals were much heavier and the proportion of the total that became available for human consumption in any one year became higher as they reached mature weight more quickly and horses were replacing oxen at the plough. As a result, the availability of meat was greater in the late eighteenth century than at the end of the seventeenth. In any case, the fall in numbers was only temporary. Towards the end of the eighteenth century the cattle population increased, the trend being reflected in consistently rising cattle sales at Smithfield after 1766 (Table IV.3).⁴⁰ Needless to say, the moneyed classes would not have been unduly affected by any passing shortfall in numbers even if this was reflected in higher prices of meat. The number of sheep in England rose fairly consistently during the eighteenth century. Gregory King reckoned their number to be 11 million in 1696.⁴¹ By 1770, Arthur Young's estimate was almost 29 million.⁴²

Gauging changes in the pig population has been difficult as production was highly localized, but their commercial importance grew with the price of pigs relative to cattle increasing considerably between the sixteenth and mid-eighteenth centuries.

³⁸ King, *op. cit.*, note 26 above, p. 37.

³⁹ Fussell, *op. cit.*, note 22 above, p. 178.

⁴⁰ B R Mitchell, *British historical statistics*, Cambridge University Press, 1988, p. 708.

⁴¹ King, *op. cit.*, note 26 above, p. 37.

⁴² Fussell and Goodman, *op. cit.*, note 24 above, p. 132.

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Poultry production rose by about 25 per cent in the first half of the eighteenth century.⁴³ Egg production per bird became greater with better feeding and management. When compared to the present day, the overall increase in the amount of fat in poultry at the time of slaughter was all the greater because ducks and geese then formed a higher proportion of the poultry consumed than is now the case. Ducks tend to become fatter than chickens, as do geese as they instinctively eat to an unlimited extent whenever the opportunity arises, because of their need to build up reserves of energy for migration.

With controlled serving of cows, which come on heat about once a month, calving could be spread over the entire year and with assured and improved cattle nutrition milk yields increased and lactation after each calving could be prolonged by twenty to thirty days. As a result, milk became more plentiful and available throughout the year. In the late eighteenth century it was not uncommon for the middle and upper classes to keep a cow or two in a stall or field adjacent to their homes in order to ensure a continuous and abundant fresh milk supply for their households. Breeding of dairy cattle had as its main objective increase in the richness as well as the quantities of the milk produced. Specifically, Jersey and Guernsey cows were imported from the Channel Islands and bred in the south of England on an increasing scale. Guernsey cows were often crossed with Devon bulls, the offspring being particularly good milkers. Animals with poor milk yields were culled unhesitatingly. As a result of these changes early eighteenth-century annual milk yields of about 150 to 300 gallons per cow rose by the end of the century to 350 to 500, and even on occasion 600 gallons a year.⁴⁴ Milk was used increasingly for large-scale commercial production of cheese, butter and cream, as these were easier to transport than liquid milk.

Variations of up to 3 per cent in the fat concentration of milk can be produced by diet modification,⁴⁵ and analyses conducted in the twentieth century showed that by selective breeding and appropriate feeding the fat content can be raised in some instances to over 5.1 per cent, Jerseys and Guernseys in particular being noted for high fat content.⁴⁶ It is therefore probable that the eighteenth-century developments that have been described resulted in milk becoming creamier as well as more plentiful.

All the changes that have been described were driven in large measure by consumer demand for fatty foods. Notwithstanding current warnings about associated cardiovascular health risks, even contemporary consumers have been found to show a liking for fatty foods and to choose them preferentially. Lean meat tends to be dry and somewhat tough, whilst marbled meat is more tender. Fatty meat has a pleasant moist taste and a smooth feel to the tongue. The texture of meat as sensed in the mouth is enhanced by frying and the aroma makes it all the more appetizing.⁴⁷ It is

⁴³ J A Chartres, 'The marketing of agricultural produce', in Joan Thirsk (ed.), *The agrarian history of England and Wales, Volume V: 1640–1750. II. Agrarian change*, Cambridge University Press, 1985, p. 446.

⁴⁴ C H Eckles, *Dairy cattle and milk production*, 5th ed., revised by E L Anthony, New York, Macmillan, 1956, p. 206.

⁴⁵ J D Sutton, 'Altering milk composition by feeding', *J Dairy Sci*, 1989, 72: 2801–14, p. 2802.

⁴⁶ J P Gibson, 'Altering milk composition through genetic selection', *J Dairy Sci*, 1989, 72: 2815–25, p. 2816.

⁴⁷ Adam Drewnowski, 'Sensory properties of fats and fat replacements', *Nutr Rev*, 1992, 50 (4, Part 2), pp. 17–20.

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unlikely that these preferences were any different 250 years ago. In the late eighteenth century, butchered carcasses were sold by weight with relatively little influence of other meat qualities on price. Dairy products and baked foods with a high animal fat content were similarly appreciated and in demand. Valuing foods for freedom from fat is a modern trend driven mainly by concern for health.

The production of ever greater amounts of animal produce was accompanied by an increasingly efficient distribution system. Coastal traffic, an ever more extensive canal network and better roads made transport of all commodities easier.⁴⁸ Growth in importance of market towns further facilitated movement of produce from farmer to consumer. The financial instruments needed to back these movements were being developed at the same time. They included growing use of paper transactions and increasing availability of credit with the beginnings of a banking system.⁴⁹ With all of these changes periods of food shortage became less frequent, less severe and more localized in their effects when they did occur.

It can be concluded that the eighteenth-century Agricultural Revolution in England resulted in better care and nutrition and an increase in the numbers and weights of farm animals, with a resulting greater and year-round availability of fatty meat, pure animal fat, eggs and increasingly creamy dairy products. The quantitative increase in production exceeded the rate of human population growth. As a consequence, the amount of meat and fat of animal origin available per person became very much greater and for both the upper and the growing middle classes they were usually readily affordable. The impact of these changes upon English everyday eighteenth-century eating habits and their potential cardiac consequences are discussed in the next chapter.

It has been noted earlier that angina pectoris appeared to have been uniquely a “British disease” for about half a century following its first recognition.⁵⁰ As pointed out in the previous chapter, country to country demographic differences are insufficient to account alone for this singularity. Parenthetically, a genetic basis is also unlikely. The peoples of eighteenth-century England were akin to those of northern and western Europe, whence they had migrated in waves from prehistoric times onwards and the European population of the eastern American seaboard consisted very largely of migrants from Britain. The cases reported in the UK in the late eighteenth century were dispersed as far apart as London, Bath, the west country and Ulster.⁵¹ Any predisposing mutational changes are therefore highly improbable. In the next chapter reasons are given for concluding that of all the changes in Georgian England that contributed to the early emergence there of angina pectoris, the impact of the Agricultural Revolution on diet played the leading role. However,

⁴⁸ J A Sharpe, *Early modern England: a social history 1550–1760*, London, Edward Arnold, 1988, p. 141.

⁴⁹ Christopher Clay, ‘Landlords and estate management in England’, in Joan Thirsk (ed.), *The agrarian history of England and Wales, Volume V: 1640–1750. II. Agrarian change*, Cambridge University Press, 1985, p. 178.

⁵⁰ William L Proudfit, ‘Origin of concept of ischaemic heart disease’, *Br Heart J*, 1983, **50**: 209–12, p. 209.

⁵¹ J O Leibowitz, *The history of coronary heart disease*, London, Wellcome Institute of the History of Medicine, 1970, pp. 83, 94, 96, 97.

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Table IV.4

Absolute and relative risk of death according to use of wine, beer or liquor (abstainers 1.0; confidence limits bracketed)

Number	Deaths	Cause	Wine	Beer	Liquor
28,488	426	All	0.8 (0.7–0.9)	0.9 (0.8–1.1)	1.0 (0.8–1.1)
21,152	318	CHD	0.5 (0.4–0.7)	0.7 (0.5–0.9)	0.6 (0.5–0.8)
20,492	597	Liver Disease	5.6 (1.1–27.7)	5.1 (0.9–28.5)	4.8 (0.9–24.6)

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before examining in detail the differences between England and other countries with respect to agricultural practice at that time, it is necessary to review briefly one other reason that has been proposed. It was advanced by Samuel Black as early as 1819. Having observed that angina pectoris was a complaint that had not been observed in France, he suggested that this was attributable to a protective effect of the red wine of which its inhabitants partook liberally.⁵² This belief has survived to the present day, but closer examination suggests that it is a very unlikely explanation. Firstly, the privileged English classes themselves drank large quantities of French wines during the late eighteenth century whilst claret, sherry and port, which are all basically variations of red wine, also enjoyed very great popularity among them. Secondly, there is recent evidence to suggest that any protective effect of alcohol is attributable to the alcohol itself irrespective of the type of drink and then only when consumed in moderation, hardly a characteristic of the eighteenth-century drinker (Table IV.4).⁵³ Finally, it would not explain the then virtual absence of angina pectoris as a complaint in other countries where red wine was not the usual alcoholic drink.

With rare exceptions, the changes accompanying the Agricultural Revolution in England and their consequences were delayed elsewhere for at least half a century. The social and political climate in the British North American colonies and in the subsequent United States were conducive to the development of farming societies that resembled English rather than Continental European patterns. However, agricultural commerce was hampered by trade barriers between the colonies of British North America and between the thirteen states during the years between the securing of independence and establishment of federal government in 1789. Inevitably too, disruptions to farming accompanied Indian raids, French incursions and the War of American Independence. Eighteenth-century settlement was confined to areas east of the Appalachians. The prairies, with their wide expanses suitable for raising cattle, were as yet unexplored. Machinery was not then available and land for agriculture had to be carved out of the forests by hand labour. Much of the farmland that

⁵² Samuel Black, *Clinical and pathological reports*, Newry, Alexander Wilkinson, 1819, p. 8.

⁵³ A L Klatsky, M A Armstrong and G D Friedman, 'Risk of cardiovascular mortality in alcohol drinkers, ex-drinkers and non-drinkers', *Am J Cardiol*, 1990, 66: 1237–42, p. 1240.

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became available was set aside for cash crops such as cotton and tobacco.⁵⁴ Time was necessary for improvement of pastures by measures that included the planting of appropriate grasses and liberal manuring. Optimal feeding of large numbers of farm animals with a resulting increase in weight and fat content had to await the future opening up of the West.

In most of western and central Europe feudal patterns of land tenure survived until the early nineteenth century. Landowners rarely took any personal interest in either their properties or in the welfare of their tenants, both being viewed exclusively as sources of income. Concerns with day-to-day farming problems were considered beneath the dignity of the absentee seigneur. In pre-revolutionary France, in particular, the nobles “had little desire to manage their farms themselves as was done in England” and “considered seigneurial rights a more attractive source of income than agricultural improvement”.⁵⁵ In most of mainland Europe the peasants who cultivated the land had the status of serfs in practice, if not formally and legally. Their obligations to the seigneur were onerous and numerous, their security of tenure minimal.⁵⁶ Feudal bonds usually ended with the death of the peasant when the seigneur had the right to repossess the land and to choose a successor, who would in turn be bound to assume all the obligations and restrictions of serfdom.⁵⁷ The inherent inefficiencies of strip farming were frequently compounded by the requirement that the individual peasant conform to communal farming patterns. As a consequence of all these factors, there was little incentive or possibility for any one peasant to improve either his land or his farming practices. An authoritarian system of government and a rigidly stratified and legally enforced structure of society contributed further to the stifling of any initiative that might have remained. Strip farming was the rule on the Continent until the end of the eighteenth century and even beyond.⁵⁸ Rulers occasionally attempted to end serfdom, either under the influence of the Enlightenment or, less altruistically, in order to weaken the power of overmighty nobles. These endeavours were usually brought to naught by resistance on the part of the nobility, even when the French Revolution was followed by abolition of serfdom in France and in its European conquests. The lands formerly owned by the nobility were then confiscated but frequently bought back by “men of straw” who were acting as intermediaries for the former owners; there was little change in farming methods. In any case, the liberalizing tendencies were reversed to a large extent after Napoleon’s final defeat at Waterloo and the restoration of the ancien régime.⁵⁹

In comparison to England, the various support systems needed to facilitate changes in agricultural practice were much less developed on the Continent. During the period from 1754 to 1784, 81 per cent of yeoman farmers and 54 per cent of

⁵⁴ Samuel Eliot Morison, *The Oxford history of the American people*, New York, Oxford University Press, 1965, p. 304.

⁵⁵ B H Slicher van Bath, *The agrarian history of western Europe A.D. 500–1800*, transl. Olive Ordish, London, Edward Arnold, 1965, p. 322.

⁵⁶ *Ibid.*, p. 189.

⁵⁷ *Ibid.*, p. 52.

⁵⁸ *Ibid.*, pp. 55ff.

⁵⁹ *Ibid.*, p. 322.

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husbandmen were literate in England. The literacy rate of rural Europe was much lower. In 1800 the percentage of husbandmen who could sign their names was 62 in England, 47 in France and 40 in East Prussia.⁶⁰ In the eighteenth century reading was frequently taught well before writing, and the latter often confined to a signature. Ability to sign one's name was consequently a frequent marker of ability to read adequately.⁶¹ It was only those who could read who could benefit from the books and pamphlets describing the new agricultural practices. The banking system and other means of obtaining credit were relatively advanced in England, but on the Continent borrowing at other than usurious rates of interest was much more difficult. The backward state of Continental industrialization meant that many of the new agricultural implements which became available in England were simply not obtainable elsewhere, even in the unlikely event that knowledge of their existence and means for their purchase were available. Movement of farm produce was impeded by the condition of the roads, which were in much poorer state than in England. In contrast to England where there were no internal restrictions upon the freedom of movement of commerce, there were in France a variety of internal tariffs and protectionist barriers to trade that hampered movement of farm produce for sale in any but local markets. A similar situation existed in eighteenth-century Germany and Italy, but in aggravated form as both countries were fragmented into many small states.⁶² Lastly, the very frequent wars of the period were accompanied by considerable setbacks to farming as a result of both physical destruction and the depredations of armies. Seed grain was frequently seized, breed stock slaughtered and horses commandeered. There were a few exceptions to the prevailing backward patterns, notably in the Netherlands where agriculture was relatively more advanced. However, that country was fought over repeatedly and its small size and high population density dictated an emphasis on growing cereals and vegetables for human consumption. Animal husbandry requires large areas of land for pasturing and these were simply not available.

In southern Europe, the Mediterranean climate had long determined the pattern of farming. In particular, the long dry summers and frequent droughts often affected crop yields adversely, hampered production of fodder and impoverished pasture lands, limiting the number of farm animals that could be grazed and the extent to which they could be fattened. As early as the Renaissance, travellers from northern Europe who visited Mediterranean countries commented on how lean the cattle and sheep were. Cattle at slaughter yielded a mere average of 148 kilograms of meat and sheep as little as 12 kilograms.⁶³ Agricultural practices in Mediterranean lands consequently placed relatively little emphasis on raising farm animals. Most of the available acreage was devoted to cereal production, orchards, olive groves and vineyards.

⁶⁰ D Grigg, *The transformation of agriculture in the west*, Oxford, Blackwell, 1992, p. 118–19.

⁶¹ R S Schofield, 'Dimensions of illiteracy 1750–1850', *Explorations in Economic History*, 1972–3, 10: 437–54, pp. 440–1.

⁶² Carlton J Hayes, Marshall W Baldwin and Charles W Cole, *History of Europe*, 2 vols, New York, Macmillan, 1956, vol. 2, p. 98.

⁶³ Fernand Braudel, *The Mediterranean and the Mediterranean world in the age of Philip II*, transl. S Reynold, 2 vols, Berkeley, University of California Press, 1995, vol. 1, pp. 238–44.

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As the historian H A L Fisher has written, “Earlier by more than half a century than any other country in Europe, England assumed the character of a modern high-farming industrial state”.⁶⁴ Half a century is roughly the interval that separates the emergence of angina pectoris in England from its first manifestation in any other country on the European mainland. A connection between these two is postulated in this and succeeding chapters.

⁶⁴ H A L Fisher, *A history of Europe*, London, Edward Arnold, 1946, p. 777.