

## IV

# English agrarian history 1500-1850

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### 1. Introduction

Inevitably perhaps, this is a selective and personal account. It is selective because it is impossible to do justice to the richness of English agrarian history within the confines of a short survey paper, and it is personal because my interpretation of significant trends and developments reflects my own views shaped by over twenty-five years of research. The bulk of this paper is concerned with an overview of the developments in English agrarian history that historians have regarded as significant in some sense, but it is prefaced by a short survey of the literature on English agrarian history.

### 2. Agrarian history before 1939

The early generation of English agrarian historians was mainly concerned with institutional or structural changes in the organisation of farming, particularly with the origins and consequences of capitalist agriculture in England.<sup>1</sup> They followed in the footsteps of Marx who saw parliamentary enclosures of the eighteenth and nineteenth centuries as responsible for creating the English proletariat, by removing common property rights and creating large farms employing labour. Also concerned with agrarian structures was N.S.B. Gras' analysis of the evolution of the English corn market, and later, Barnes' analysis of the grain trade.<sup>2</sup> This work on institutional change is still of relevance today, mainly because, until comparatively recently, subsequent work in English agrarian history has been more concerned

1. M. Overton, 'Agrarian history', in J. Cannon et al (eds.), *A dictionary of historians* (Oxford, 1988) 5-7; R.H. Tawney, *The agrarian problem in the sixteenth century* (London, 1912); J.L. Le B. Hammond and B. Hammond, *The village labourer 1760-1832* (London, 1913).

with the technical aspects of agricultural production; an approach sometimes termed ‘cows and ploughs’ agricultural history. This approach has its origins with Toynbee’s lectures on the industrial revolution which contains what amounts to an early description of the traditional English agricultural revolution, subsequently incorporated in Ernle’s famous text, *English farming past and present*, published in 1912.<sup>3</sup>

### 3. The Agrarian History of England and Wales

By the 1950s agricultural history in England had come of age, marked in 1953 by the foundation of the British Agricultural History Society and publication of the first issue of the *Agricultural History Review*.<sup>4</sup> From modest beginnings the subject grew, benefiting from the expansion of economic history and historical geography in the 1960s and 1970s, from which the bulk of its practitioners continue to be drawn. The establishment of local record offices in each county made more primary evidence available for studies of individual farms, villages, localities and estates. The number of PhDs on agrarian topics increased significantly and local history, much of it rural and agrarian, began to thrive.<sup>5</sup> Under the leadership of such scholars as W.G. Hoskins, H.P.R. Finberg and Joan Thirsk – the so-called ‘Leicester school’ of agrarian historians – the subject was steered away from national studies dealing with mainly legal and institutional matters towards local studies emphasising farming practice. A comprehensive *Agrarian History of England and Wales* was conceived in 1956 as an eight-volume collaborative work and intended to provide an up-to-date and scholarly account of the development of English agriculture from prehistoric times down to the outbreak of the Second World War.<sup>6</sup> Volume IV, edited by Thirsk, was the first to appear in 1967 and Volume VII edited by E.J.T. Collins dealing with the period 1850-1914 will be the last.<sup>7</sup> Collectively it will

2. N.S.B. Gras, *The evolution of the English corn market from the twelfth to the eighteenth century* (Cambridge, Mass., 1915); D.G. Barnes, *A history of the English corn laws from 1660-1846*, New Haven, 1930; reprinted New York, 1961 and 1965).

3. A. Toynbee, *Lectures on the industrial revolution in England* (London, 1884); R.L. Prothero, *English farming past and present* (London, 1912). Prothero later became Lord Ernle.

4. The *Agricultural History Review* is published twice a year by the British Agricultural History Society. Further details from the Membership Secretary, Department of Economic and Social History, University of Exeter, Exeter EX4 5RJ, UK, e-mail BAHS@Exeter.ac.uk.

5. R. Morgan, *Dissertations on British agrarian history*, Institute of Agricultural History, Bibliographies in Agricultural History, number 2 (Reading, 1981).

6. H.P.R. Finberg, ‘An agrarian history of England’, *Agricultural History Review*, Vol 4 (1956) 2-3.

7. The volumes dealing with the period covered by this paper are: J. Thirsk (ed.), *The agrarian history of England and Wales IV, 1500-1640* (Cambridge, 1967); J. Thirsk (ed.),

amount to over 8,000 pages, with contributions from over 70 different authors. The volumes contain the results of much original research and are a veritable encyclopaedia of information on a wide array of agrarian topics. As a set they provide a striking contrast to the slender, single-volume, accounts of agriculture on the continent of Europe.

The *Agrarian Histories* exemplify the logistical and methodological difficulties of creating a truly comprehensive and comparative agrarian history, and in content and approach they embody both the strengths and the weaknesses of British agrarian history. All are firmly grounded in the documentary evidence, and provide a vast amount of new information, including new series of prices and wages which supersede those of Rogers.<sup>8</sup> In almost every case national trends are reconstructed by a 'bottom-up' process of aggregation from separate local and regional studies and there are very few attempts to generalise or treat agrarian history in a conceptual or theoretical way. Thus there are no general explanations of agrarian change, and very little agronomy, economics, or sociology. Perhaps because of the large-scale of the enterprise there is a lack of consistency between contributors: thus the editor of Volumes IV and V emphasises regional distinctions in terms of farming regions, while these are largely ignored in Volume VI. Even within the same volume, contributors adopt different criteria for their regional descriptions, and in the systematic chapters there is little evidence of co-operation.<sup>9</sup> There is also a preoccupation with short, relatively self-contained, time periods, which results in a number of historiographic discontinuities between periods, and inadequate long-run conceptualisations of English agrarian change. On the whole the volumes show a greater concern with supply than with demand, and in particular, a preoccupation with production methods rather than with production and output *per se*. With hindsight it is, of course, easy to criticise. By any standard the *Agrarian*

*The agrarian history of England and Wales V, 1640-1750, i Regional farming systems* (Cambridge, 1984); J. Thirsk (ed.), *The agrarian history of England and Wales, 1640-1750, ii Agrarian change*, (Cambridge, 1985); G.E. Mingay (ed.), *The agrarian history of England and Wales, VI, 1750-1850* (Cambridge, 1989).

8. J.E.T. Rogers, *A history of agriculture and prices in England from the year after the Oxford parliament, 1259, to the commencement of the continental war, 1793*, (Oxford, 1866-1902).

9. N. Davie, 'Chalk and cheese? 'Fielden' and 'Forest' communities in early modern England', *Journal of Historical Sociology*, Vol 4 (1991) 1-31.

10. For reviews of the *Agrarian Histories* covering the period 1500-1850 see: E.L. Jones, 'The condition of English agriculture 1500-1640', *Economic History Review*, Vol 21 (1968) 614-19; M. Overton, 'Depression or revolution? English agriculture, 1640-1750', *Journal of British Studies*, Vol 25 (1986) 345-7; E.A. Wrigley, 'Early modern agriculture: a new harvest gathered in', *Agricultural History Review*, Vol 35 (1987) 65-7; M. Overton, 'The critical century? The agrarian history of England and Wales 1750-1850', *Agricultural History Review*, Vol 38 (1990) 185-89.

*Histories* represent an impressive achievement and provide an unfailingly scholarly basis upon which future research can build.<sup>10</sup>

While the *Agrarian Histories* occupied many of the established English agrarian historians during the 1960s and 70s, there were a number of other important studies by younger scholars, and by those writing in a different paradigm. In the latter category are Robert Brenner's essay 'Agrarian class structure and economic development in pre-industrial Europe', E.P. Thompson's thesis of the 'moral economy', and number of other studies dealing with the social relations of agricultural production.<sup>11</sup> Although enclosure was discussed in Volume IV of the *Agrarian History*, there is little discussion of it in Volumes V and VI. However, the topic is dealt with by Yelling and Turner.<sup>12</sup> Some new approaches were adopted to traditional issues of agricultural production, involving the quantification of changes in farm enterprises,<sup>13</sup> the use of computer techniques for analysing agricultur-

11. R. Brenner, 'Agrarian class structure and economic development in pre-industrial Europe', *Past & Present*, No. 70 (1976) 30-75, reprinted in T.H. Aston and C.H.E. Philpin (eds.), *The Brenner debate: agrarian class structure and economic development in pre-industrial Europe* (Cambridge, 1985) 10-63; E.P. Thompson, 'The moral economy of the English crowd in the eighteenth century', *Past & Present*, No 50 (1971) 76-136, reprinted in E.P. Thompson, *Customs in common* (London, 1991) 185-258; E.P. Thompson, 'The moral economy reviewed', in Thompson, *Customs in common*, 259-351; K. Tribe, *Genealogies of capitalism* (London, 1981); K.D.M. Snell, *Annals of the labouring poor: social change and agrarian England, 1660-1900* (Cambridge, 1985); J.M. Neeson, *Commoners: common right, enclosure and social change in England, 1700-1820* (Cambridge, 1993); N. Gregson, 'Tawney revisited: custom and the emergence of capitalist class relations in north east Cumbria 1600-1830', *Economic History Review*, Vol 42 (1989) 18-42; R.W. Hoyle, 'Tenure and the land market in early modern England: or a late contribution to the Brenner debate', *Economic History Review*, Vol 43 (1990) 1-20; A. Charlesworth and A. Randall, 'Morals, markets and the English crown in 1766', *Past & Present*, No 114 (1987) 200-13; M. Reed and R. Wells, *Class, conflict and protest in the English countryside, 1700-1880* (London, 1990); R. Wells, 'E.P. Thompson, *Customs in Common* and moral economy', *Journal of Peasant Studies*, Vol 21 (1994) 263-307.

12. J.A. Yelling, *Common field and enclosure in England 1450-1850* (London, 1977); M.E. Turner, *English Parliamentary enclosure* (Folkestone, 1980).

13. M. Overton, 'The diffusion of agricultural innovations in early modern England: turnips and clover in Norfolk and Suffolk 1580-1740', *Transactions Institute of British Geographers*, new series, Vol 10 (1985) 205-21, reprinted in J.A. Chartres (ed.), *Pre-industrial Britain* (Oxford, 1994) 123-39; M. Overton, 'The determinants of crop yields in early modern England', in B.M.S. Campbell and M. Overton (eds.), *Land labour and livestock: historical studies in European agricultural productivity* (Manchester, 1991) 284-322; P. Glennie, 'Continuity and change in Hertfordshire agriculture 1550-1700: I – patterns of agricultural production', *Agricultural History Review*, Vol 36 (1988) 55-75; P. Glennie, 'Continuity and change in Hertfordshire agriculture, 1550-1700: II – trends in crop yields and their determinants', *Agricultural History Review*, Vol 36 (1988) 145-61.

al data,<sup>14</sup> the mathematical manipulation of crop prices to calculate yields,<sup>15</sup> and the introduction of more explicit conceptions of productivity to measure agricultural development.<sup>16</sup> Finally, three recent papers have attempted to break free from the narrow time spans of the *Agrarian Histories* by looking at changes in agricultural production from the middle ages to the nineteenth century.<sup>17</sup>

#### 4. Agricultural revolutions

The *Agrarian Histories* avoided direct entanglement with the long-running debate on the English 'agricultural revolution'. The origins of this debate date back to Toynbee and Erle who were heavily influenced by late-eighteenth century agricultural writers such as Young and Marshall when they argued for a fundamental transformation in agricultural output and production methods in the century after 1750, which was associated with an equally fundamental change in agrarian structures, principally the enclosure of open-fields and abolition of common property rights. Subsequently, claims have been made for an earlier revolution based on

14. M. Overton, 'Computer analysis of an inconsistent data source: the case of probate inventories', *Journal of Historical Geography*, Vol 3 (1977) 317-26; M. Overton, 'A computer management system for probate inventories', *History and Computing*, Vol 8 (1995) 10-17.

15. M. Overton, 'Estimating crop yields from probate inventories: an example from East Anglia, 1585-1735', *Journal Economic History*, Vol 39 (1979) 363-78; M. Overton, 'Re-estimating crop yields from probate inventories', *Journal Economic History*, Vol 50 (1990) 931-5; M. Overton, 'The determinants of crop yields in early modern England', in Campbell and Overton, *Land labour and livestock*, 284-322; R.C. Allen, 'Inferring yields from probate inventories', *Journal Economic History*, Vol 48 (1988) 117-25; P. Glennie, 'Measuring crop yields in early modern England', in Campbell and Overton, *Land, labour and livestock*, 255-83.

16. M. Overton, 'Agricultural revolution? development of the agrarian economy in early modern England', in A.R.H. Baker and D. Gregory (eds.), *Explorations in historical geography: interpretative essays*, (Cambridge, 1984) 118-39; Campbell and Overton, *Land, labour and livestock*.

17. B.M.S. Campbell and M. Overton, 'A new perspective on medieval and early modern agriculture: six centuries of Norfolk farming c.1250-c.1850', *Past & Present*, No 141 (1993) 38-105; M. Overton and B.M.S. Campbell, 'Norfolk livestock farming 1250-1740: a comparative study of manorial accounts and probate inventories', *Journal Historical Geography*, Vol 18 (1992) 377-96; M. Overton and B.M.S. Campbell, 'Production et productivité dans l'agriculture anglaise, 1086-1871', *Histoire et Mesure*, Vol 9 (1996) 255-97.

changes in farming methods,<sup>18</sup> and from attempts to measure productivity change;<sup>19</sup> while others consider Ernlé's chronology was correct, although they reject many of his specific arguments.<sup>20</sup> Some have doubted the usefulness of the concept of an 'agricultural revolution', and indeed as a concept it has not always been very clearly defined.<sup>21</sup> Nevertheless the phrase remains entrenched within the literature of English agrarian history and is contained in the title of the most recent survey of agrarian developments in England between 1500 and 1850.

## 5. Lacunae

Despite the great volume of work on English agrarian history there are plenty of topics that remain under-researched. Since most work has been concerned with agricultural production the gaps are mainly to do with the demand for agricultural products and the ways in which they were distributed. In particular more work is needed on the process of the commercialisation of agriculture. There are chapters on marketing in the *Agrarian Histories*, and some subsequent work, but much remains to be understood about market integration and the relationship between market development and agricultural production.<sup>22</sup> More specifically changes in the composition of demand are little understood. There is limited work on diet and

18. E. Kerridge, *The agricultural revolution* (London, 1967); E.L. Jones, 'Agriculture and economic growth in England, 1660-1750: agricultural change', *Journal of Economic History*, Vol 25 (1965) 1-18.

19. R.C. Allen, *Enclosure and the yeoman: the agricultural development of the south midlands 1450-1850* (Oxford, 1992); G. Clark, 'Agriculture and the industrial revolution, 1700-1850', in J. Mokyr (ed.), *The British industrial revolution: an economic perspective* (Oxford, 1993) 227-266.

20. R.C. Allen, 'Agriculture during the industrial revolution', in R. Floud, and D.N. McCloskey (eds.), *The economic history of Britain since 1700*, 2nd edn (2 Vols Cambridge, 1994) Vol 1, 96-122; J.D. Chambers and G.E. Mingay, *The agricultural revolution 1750-1880* (London, 1966); M. Overton, *Agricultural revolution in England: the transformation of the agrarian economy 1500-1850* (Cambridge, 1996); M. Overton, 'Re-establishing the agricultural revolution', *Agricultural History Review*, Vol 44 (1996) 1-20.

21. For reviews of the debate see Overton, 'Agricultural revolution'; M. Overton, 'Agricultural revolution? England, 1540-1850', in A. Digby and C.H. Feinstein (eds.), *New directions in economic and social history* (London, 1989) 9-21; Overton, *Agricultural revolution in England*; J.V. Beckett, *The agricultural revolution* (Oxford, 1990).

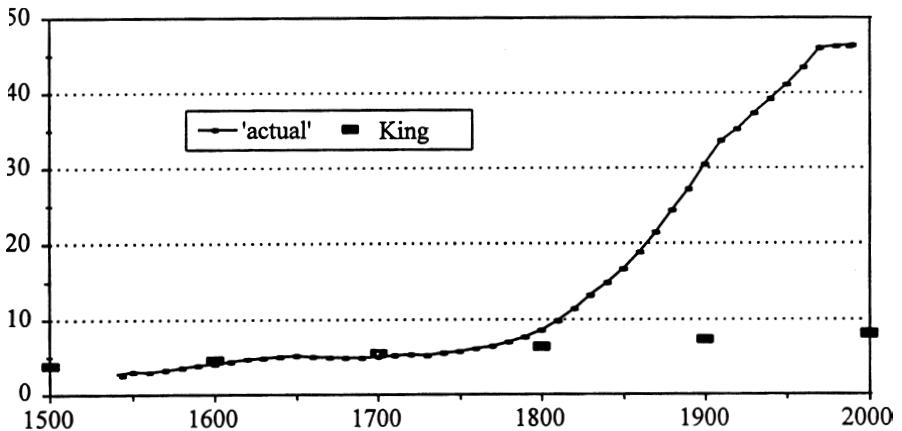
22. E. Kerridge, *Trade and banking in early modern England* (Manchester, 1988); J.A. Chartres, 'City and towns, farmers and economic change in the eighteenth century', *Historical Research*, Vol 64 (1991) 138-55; J.A. Chartres, 'Market integration and agricultural output in seventeenth-, eighteenth-, and early nineteenth-century England', *Agricultural History Review*, Vol 43 (1995) 117-38; W. Thwaites, 'The corn market and economic change: Oxford in the eighteenth century', *Midland History*, Vol 16 (1991) 103-25.

nutrition, and very little is known about the development of food processing, and the food chain, before the mid-nineteenth century.<sup>23</sup> From the supply side we need further regional studies of eighteenth and nineteenth century farming to contextualise the processes of change. While we have good evidence of the variety of farming systems for the early modern period almost no work has looked at the evolution of these systems during the period of the 'agricultural revolution'.

## 6. English agrarian developments 1500-1850

In my recent book, I argue that English agriculture experienced three fundamental transformations, which have their origins in the seventeenth century but came to fruition in the century after 1750.<sup>24</sup> The first was an unprecedented transformation in output; the second was an unprecedented increase in labour productivity in agriculture; and the third consisted of changes in the institutional structure of farming, which amount to the emergence of an agrarian capitalism. It is, of course, a matter of opinion as to whether these changes are significant enough to warrant the description of 'revolution', but I believe them to be so for the following reasons. Until the late eighteenth century contemporaries thought that the English population could

Figure 1. *Gregory King's estimates of English population (millions)*



Source: Overton, *Agricultural revolution*, 63-5.

23. D. Oddy and D. Miller (eds.), *The making of the modern British diet* (London, 1976); Overton and Campbell, 'Production et productivité dans l'agriculture anglaise'.

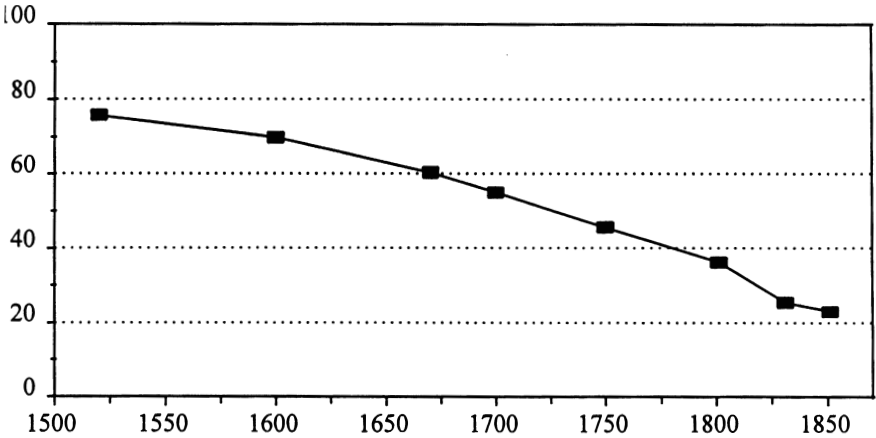
24. Overton, *Agricultural revolution in England*.

not grow rapidly because extra people could not be fed by English agriculture: they argued that the land area was fixed, and that the addition of more inputs would lead to diminishing returns. But they were wrong. Figure 1 shows the population projections of Gregory King made in the late seventeenth century compared with the actual population totals as computed by Wrigley and Schofield. In 1750 English population stood at about 5.5 million. It had reached that level probably at least three times before: in the Roman period, around 1300, and again in 1650. But once the population had reached this ceiling it ceased to grow, essentially because a Malthusian check of some sort caused population to stabilise or decline, since the agricultural sector of the economy could not respond to the pressure of feeding extra people. But, contrary to expectation, population grew to unprecedented levels after 1750, because agricultural output did expand.

By 1800 England had the lowest proportion of its population engaged in farming of any country in the world (Figure 2). This is important because of what the people not involved in farming were doing. An industrial revolution is impossible without a fall in the proportion of the population engaged in agriculture, since, by definition, an industrial revolution is a dramatic increase in the proportion of the population engaged in industrial or non-agricultural activities. And, arguably, the industrial revolution is the most important single event or process in English history.

Changes in institutional structures consisted of a series of interrelated changes in tenures, property rights, and commercialisation of English farming. They are of significance because of their relationship to output and productivity change, but they are also significant in their own right. The new farming framework had a

Figure 2. *The English rural agricultural population (as a % of total population)*



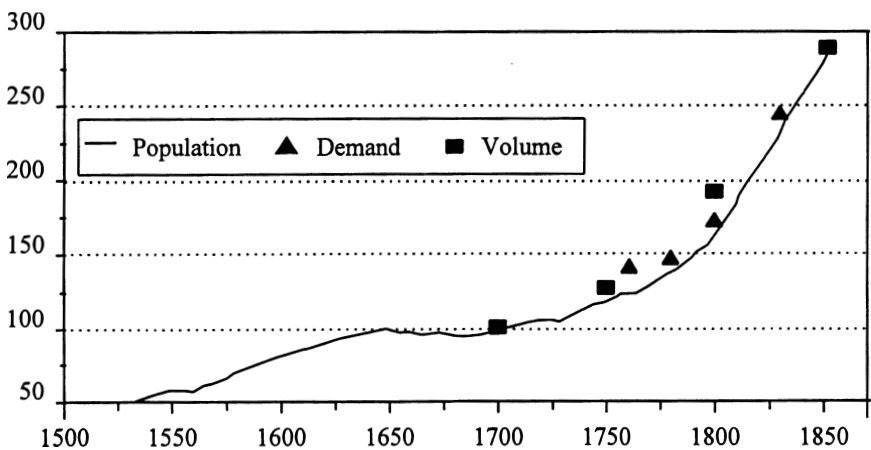
Source: Overton, *Agricultural revolution*, 82.

profound impact on the relationships between the people involved in agricultural production and changed rural ways of life irrevocably.

Given the significance of these three changes, the next task is to attempt both to measure them, and to explain them. This is difficult, partly because of the nature of surviving historical sources, but also because these questions have not been specifically asked by English agrarian historians in the past. Nevertheless, the starting point must be an attempt to measure agricultural output and productivity. Ideally, the explanation of changes in output and productivity should relate specific processes of change to particular farming systems in terms of their economic, social, and ecological environments. As relatively little work has been carried out on varieties of farming system in the eighteenth and early nineteenth centuries (in contrast to the sixteenth and seventeenth centuries) this is impossible, and so the explanations of change are necessarily restricted to a discussion of the processes of change alone, rather in isolation from particular farming environments, although there are plenty of examples of each of these processes at work.

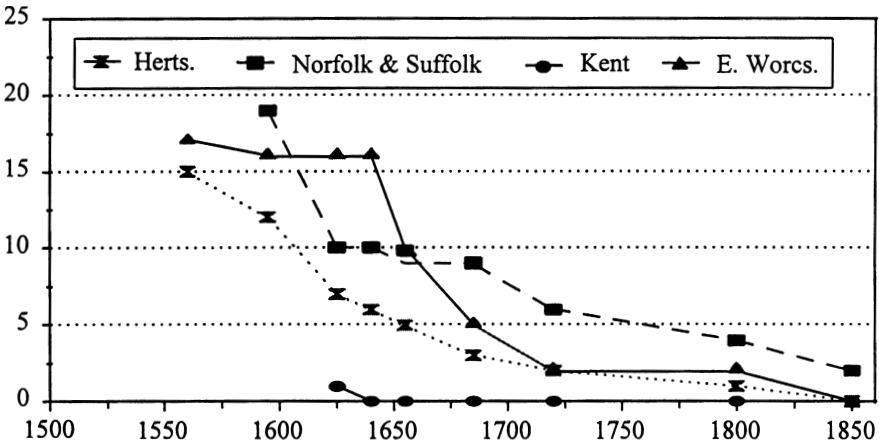
In the absence of nationwide agricultural statistics before 1866, we can use three indications of output: population based statistics, assuming constant consumption per head but making an allowance for exports and imports; volume based statistics which are derived from contemporary estimates; and a demand based technique which constructs a demand curve for agricultural products and uses prices (about which we do have information) to infer output. The three estimates, shown in Figure 3, are in very broad agreement: agricultural output increased nearly threefold from 1700-1850, and growth after 1750 was much more rapid than that before.

Figure 3. *English agricultural output 1500-1850 (1700=100)*



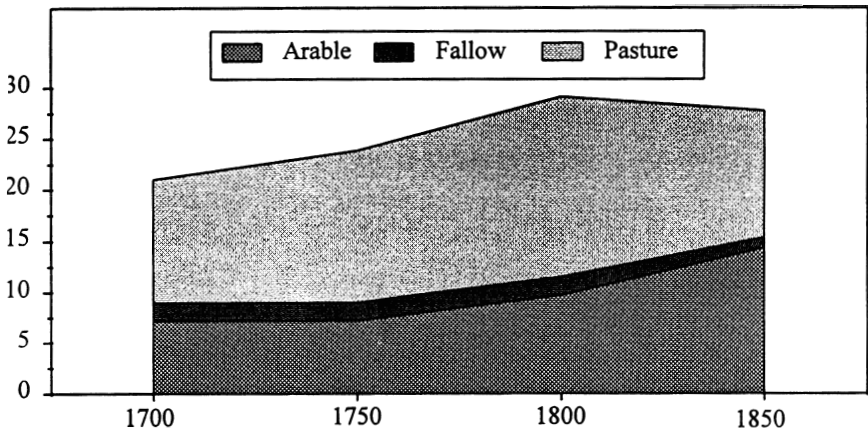
Source: Overton, *Agricultural revolution*, 75.

Figure 4. Rye in England 1550-1850



Source: Overton, *Agricultural revolution*, 94-5.

Output was increased through two general processes: first through the intensification of agricultural production, and second through an increase in crop yields and the productivity of livestock. There are many examples of changes in land use from low intensity to high intensity. One of the most dramatic is large scale land reclamation, especially the draining of the fenlands of eastern England from the seventeenth century when a low intensity agricultural system based on fishing and fowling was replaced by a high intensity system based on arable crops. Other examples include the clearing of woodland and the reclamation of upland pastures. This extent of this activity is impossible to quantify, but may have affected some 30 per cent of the agricultural area of England from the mid-seventeenth to the mid-nineteenth centuries. In addition to this land reclamation, there were changes in the mix of crops grown. If the crop mix changes to favour more productive crops then overall output will increase even if the yields per acre of the individual crops do not change. One example that is fairly easy to demonstrate is the decline of rye shown in Figure 4. This shows that in some English counties (for example, Kent) rye was never widely grown, but in others (for example, Norfolk, Suffolk, Hertfordshire, and east Worcestershire) its share of arable land (excluding fallow) fell from around 15 to 20 per cent to under 5 per cent. As the proportion of rye fell, so the proportion of more productive crops, wheat and barley, rose. Another example is the spread of the potato from the mid-eighteenth century, it has been estimated that a hectare of potatoes produced two and a half times as many calories as a hectare of wheat.<sup>25</sup>

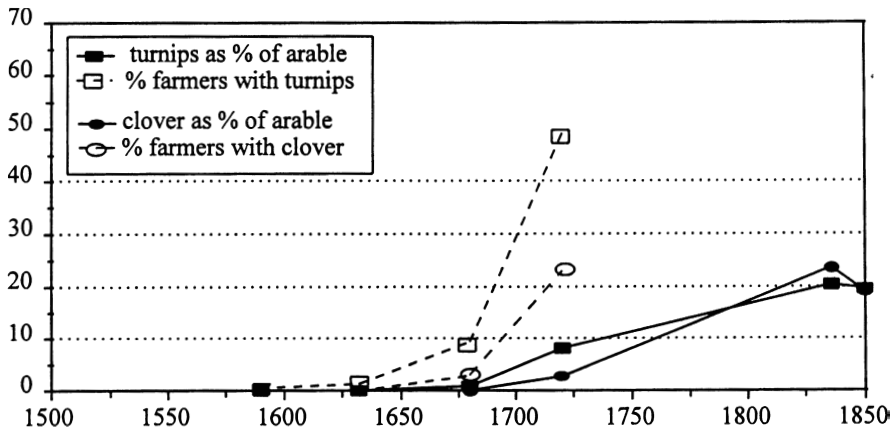
Figure 5. *Land use in England 1700-1850 (million acres)*

Source: Overton, *Agricultural revolution*, 76.

The balance between arable and permanent pasture also changed so that productive arable land was replacing permanent pasture as Figure 5 shows.

This does not mean that fodder supplies were falling, quite the reverse, for the loss of permanent pasture was made good by new fodder crops in arable rotations, especially turnips and clover. Not only did these crops result in an increase in fodder yields, but they were also instrumental in the reclamation of many lowland heaths from rough pasture to productive arable farms. The most important new crop in this context was the turnip, which was also important because it enabled fallows to be reduced, since turnips could be hoed while they were growing. Thus fallow was about 20 per cent of arable in 1700, but it steadily declined to reach only 4 per cent in 1871. We have good quantitative data on the crops grown in many parishes in England in the 1830s from the tithe files, and using this data the correlation between the proportion of arable under fallow and the proportion of arable under turnips is  $-0.9$  which strongly suggests that turnips were replacing fallows. For earlier periods probate inventories enable us to count the frequency with which turnips (and other new crops such as rape) were mentioned and give a more precise answer to the chronology of their introduction. In fact, we can measure their spread in two ways, through the proportion of farmers growing them, and the proportion of the arable acreage they took up. Despite the fact that turnips first appear as a field crop in the 1620s and by the 1720s they were grown by over 50 per cent of farmers in Norfolk and Suffolk, their impact as a proportion of the

25. *ibidem*, 102.

Figure 6. *Turnips and clover in Norfolk and Suffolk 1550-1850 (percentages)*

Source: Overton, 'Determinants of crop yields', 306-7.

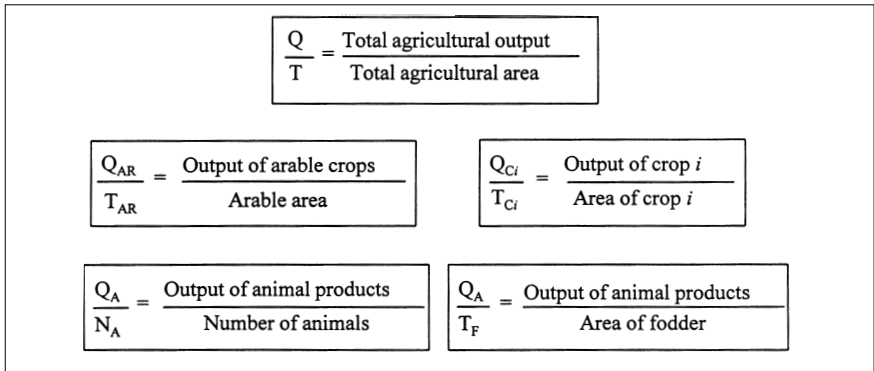
arable area did not come until the early nineteenth century as Figure 6 demonstrates.<sup>26</sup>

Although the spread of new fodder crops can be quantified quite easily, some of the other ways in which output increased await measurement. It is highly likely for example, that regional and local specialisation increased. There is some general evidence of this from probate inventories in terms of production changes, and it would also seem very likely given the improvements in marketing that we are able to trace in the eighteenth century. The theory of absolute and comparative advantage, usually applied to overseas trade, explains why this could have increased output when we apply it on a regional basis in England, and provides a useful hypothesis to test.

Thus agricultural production was intensified by land reclamation, by changing the crop mix, and by introducing new fodder crops. If we regard the agricultural land area of the country as fixed, then we can see these changes as contributing to increases in land productivity. The first formula in Figure 7 shows the preferred measure of land productivity, total agricultural output divided by total land area, but in an historical context this is very difficult to measure for we have only rough indications of output and land area in the eighteenth century, and none before 1700. Historians therefore employ a more limited measure of land productivity, crop

26. M. Overton, 'Weather and agricultural change in England, 1660-1739', *Agricultural History*, Vol 43 (1989) 77-88; M. Overton, 'Agriculture', in J. Langton, and R. Morris (eds.), *An atlas of industrializing Britain 1780-1914* (London, 1986) 34-53.

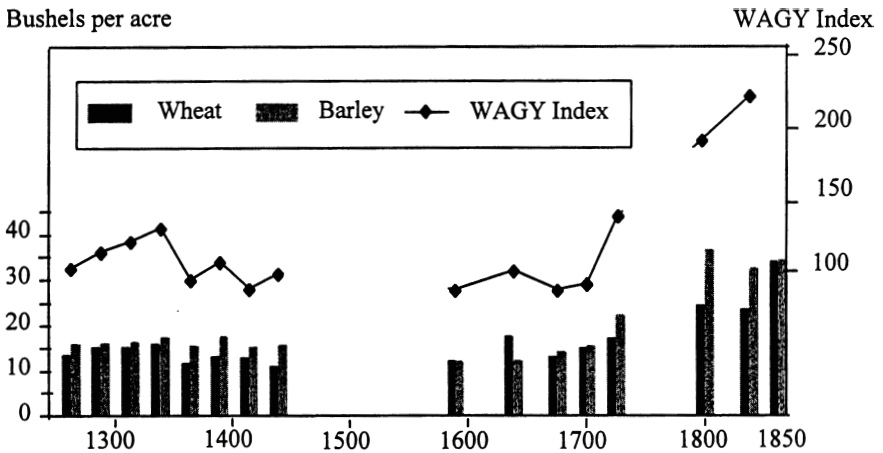
Figure 7. Measures of land productivity



yields per sown acre (the output of a crop divided by its sown area). This is the measure farmers like to boast about, and it is a measure for which we have considerable evidence, but it is a partial measure. We should also look at productivity in terms of the arable area (the output of arable crops divided by the arable area, which therefore takes fallow into account), but cannot do so because there is no information on fallows until the 1830s.

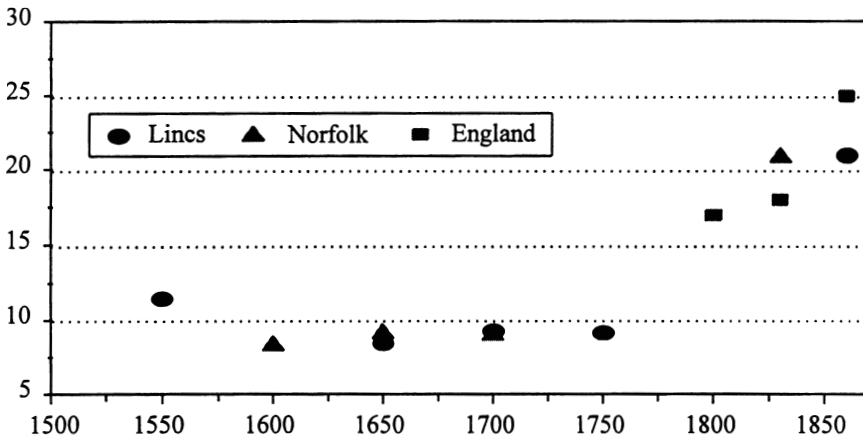
Crop yields per sown acre were directly recorded in the middle ages, and together with some nineteenth-century estimates we can chart grain yields. Few docu-

Figure 8. Norfolk cereal yields 1250-1850



Source: Campbell and Overton, 'Six centuries of farming', 70.

Figure 9. WAGY yields in England 1550-1850 (bushels per acre)



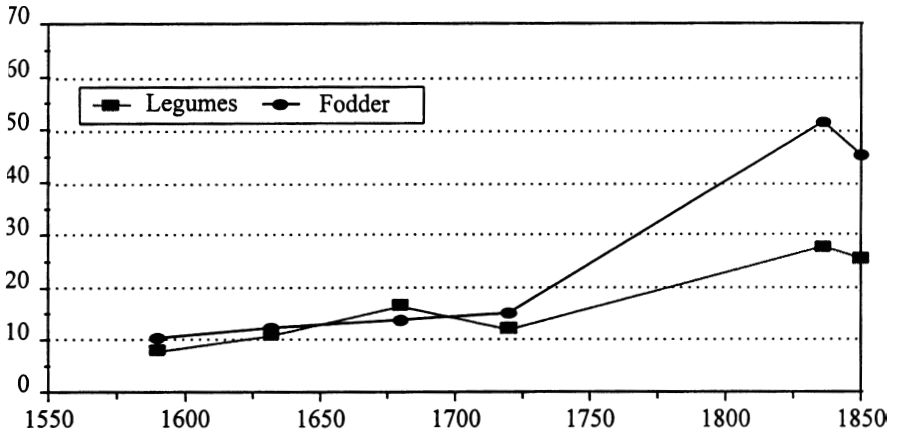
Source: Overton, *Agricultural revolution*, 77.

ments record yields directly in the intervening period but by making some assumptions about how crops were valued in probate inventories and making some mathematical manipulations, we can estimate grain yields from probate inventories. Putting the data together shows that for the county of Norfolk at least (Figure 8), the surge in yields came in the eighteenth century and not before: average yields per sown acre did not exceed the best medieval levels until after the 1730s and 40s. This is also suggested in Figure 9 which brings together probate inventory evidence from Norfolk and Lincolnshire together with some national estimates for the period after 1801.

The key to increasing cereal yields was nitrogen: since nitrogen was the 'limiting factor' in determining cereal yields before about 1830.<sup>27</sup> Farmers did not know of the existence of nitrogen but we can interpret many of their actions in terms of the conservation of existing stocks of nitrogen and the addition of new nitrogen to the soil. Existing stocks were exploited, for example by ploughing up permanent pasture; available nitrogen was conserved, for example by feeding bullocks in stalls, collecting their manure, and placing it where it was needed; but, most importantly, by adding new nitrogen to the soil using legumes. Legumes are a class of plant which have bacteria attached to their roots which convert atmospheric nitrogen into nitrates in the soil that can be used by plants. Legumes had been sown since the middle ages as peas, beans, and vetches, but from the mid-seventeenth century

27. R.S. Shiel, 'Improving soil fertility in the pre-fertiliser era', in Campbell and Overton, *Land, labour and livestock*, 51-77.

Figure 10. *Fodder and legumes in Norfolk and Suffolk 1550-1850 (% of arable area)*



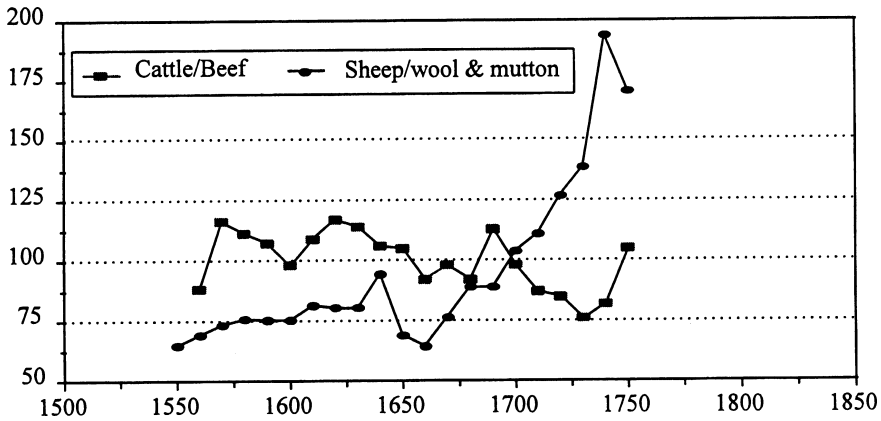
Source: Overton, 'Determinants of crop yields', 306.

farmers began to grow clover, both white and red, and by the nineteenth century had dramatically increased the quantity of nitrogen available for cereal crops: perhaps by over 60 per cent. Once again this can be illustrated for Norfolk and Suffolk using the evidence from probate inventories combined with later data (Figure 10).

Livestock output increased for two reasons (see Figure 7). First because improved fodder supplies meant that livestock densities could increase, and second because cattle took less time to mature or 'finish' and be ready for the butcher. Prices also enable us to look at the yields of livestock products per beast, by relating the price of animal products to the price of the animal. Dividing the average price of a sheep by the average price of a pound of mutton for example, should give an indication of how many pounds of mutton a sheep produced. Figure 11, shows the result of this calculation for sheep and cattle, and it suggests that improvements in sheep began earlier than we have been led to believe, in the period from 1650, although for cattle there is little evidence of conspicuous change up to 1750. This is interesting for it predates the widespread use of new fodder crops and suggests there may well have been less conspicuous improvements in fodder supplies for sheep at least, or changes to sheep which predate the famous breed improvements of the late eighteenth century.

Thus output increased by a complicated mix of reasons, in part to do with rises in crop yields per sown acre and livestock yields, but also to do with intensification of production allied to new crops and crop rotations. Generally speaking (with the exception of sheep) the chronology of these improvements agrees with the

Figure 11. Ratios of animal product prices 1550-1750 (1550-1750=100)

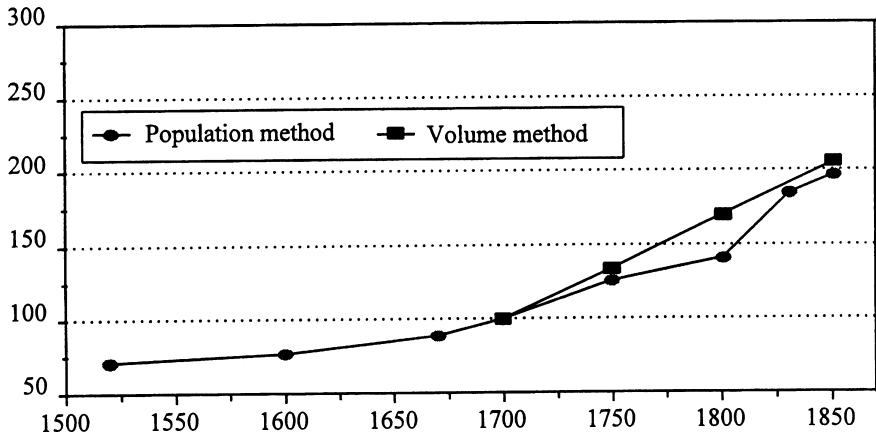


Source: Overton, *Agricultural revolution*, 116.

chronology of the increase in output. Historians have spent much less time looking at labour productivity although it is just as important.

Figure 12 shows some national estimates, simply based on the output estimates of Figure 3 divided by the size of the agricultural workforce. Very little local evidence has been collected, although it is waiting in the farm accounts sitting in county record offices. Labour productivity is a fascinating puzzle because it seems as though it did not rise through conspicuous technological innovation. Machines for reaping and threshing for example, did not become widespread until well into the nineteenth century. In the eighteenth century there is no obvious technological contender for labour productivity change, except, perhaps for improvements in plough technology. We have therefore, to look elsewhere for explanations of the rise in labour productivity. One possibility is an increase in the amount of energy available for farm work. If standards of nutrition rose above the subsistence minimum for those working on the land they should have been able to work harder. Furthermore, the switch from oxen to horses coupled with improved fodder supplies meant that English farmers had more animal power available to work the land.<sup>28</sup> Increases in farm size may also have improved labour productivity since it seems that large farms employed fewer workers per acre than did small farms. But most of these arguments are speculative: much more research remains to be done, particularly on the management and utilisation of the workforce.<sup>29</sup>

28. E.A. Wrigley, *Continuity, chance and change: the character of the Industrial Revolution in England* (Cambridge, 1988); E.A. Wrigley, 'Energy availability and agricultural productivity', in Campbell and Overton, *Land, labour and livestock*, 323-39.

Figure 12. *Labour productivity in England 1500-1850 (1700=100)*

Source: Overton, *Agricultural revolution*, 82.

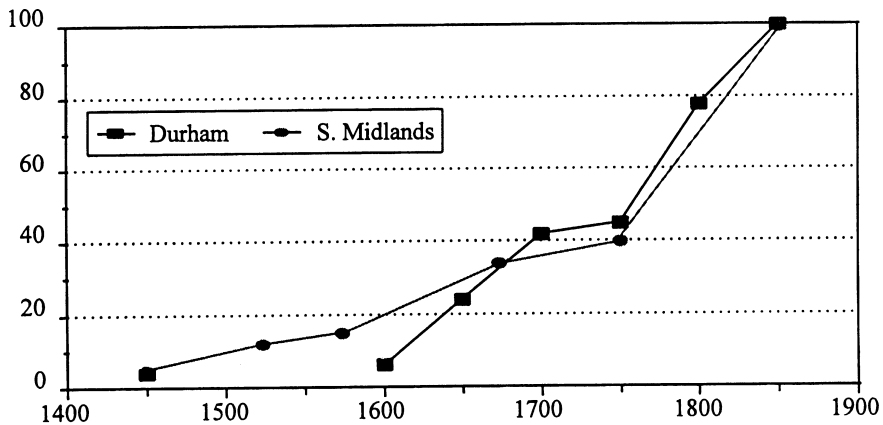
This brings us to changes in the institutional structure of farming. There has been considerable debate about both the nature of agrarian capitalism and the ways in which it came into being. There is some consensus however, that three sets of changes were of particular importance. The first was the gradual abolition of the complicated structure of feudal tenures and estates. By 1800 most farmland was farmed by tenant farmers, with a lease for a period of years, paying a rent that was a fairly accurate reflection of the annual value of the holding. This meant that landlords had more incentive to encourage improvements since they could benefit from the increased rents that might result. The second was the near universal establishment of private property rights, so that exclusive rights of ownership to a particular piece of land gave exclusive rights of use. The argument here is a very old one: why should anyone invest in improving land if other people (those with common rights) would reap the benefit? For example, one of the common rights in some village communities was the common of shack, where holders of common rights grazed their livestock on the stubble of the whole village after the harvest. No single farmer is therefore likely to have grown turnips, which would be in the ground in August and September, only to see them being eaten by others' livestock. Of course it was possible for all the farmers in a village to cooperate and innovate, but it was much less likely than individual enterprise with private property rights.

29. W.A. Armstrong, *Farmworkers: a social and economic history* (London, 1988).

Changes in property rights and tenures are often lumped together as part of the process of enclosure although they should be regarded as separate processes. Even so, in a very crude way the chronology of enclosure reflects changes in tenures and property rights. There are good statistics for enclosure carried out by act of parliament from the mid-eighteenth century, but much enclosure was undertaken without a parliamentary act (especially before 1750) so measuring the rate of enclosure is difficult. Figure 13 shows the proportion of enclosure carried out at various dates for the county of Durham and for the midlands where work has been done on pre-parliamentary enclosure. Third, farm sizes increased and the nature of employment changed. It is obvious that average farm size rose given that the proportion of the population engaged in farming fell and the area farmed did not fall. Direct evidence of changes in farm sizes is not as plentiful as it could be, but the evidence in Figure 14 from Shropshire and the midlands indicates that farms were getting considerably larger from the mid-eighteenth century as a response to growing commercialisation of agricultural production.

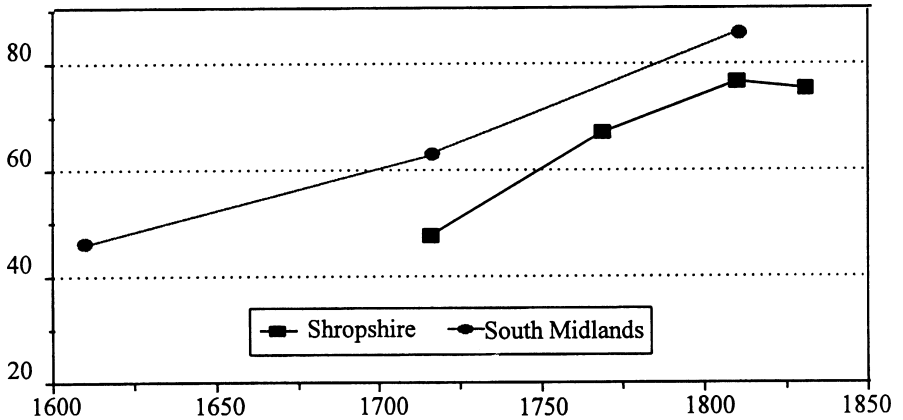
The commercialisation of the agricultural economy was the most important factor promoting changes in both output and in institutional structures. Farmers became more and more subject to the dictates of the market, markets became more integrated, and the actual methods of marketing changed. There was a considerable market in agricultural products in the sixteenth century (as there had been in the mid-

Figure 13. *Enclosure in Durham and the South Midlands 1450-1850 (% of all enclosure)*



Source: R.I. Hodgshon, 'The progress of enclosure in County Durham', in H.S.A. Fox and R.A. Butlin (eds.), *Change in the Countryside: essays on rural England 1500-1900*, Institute of British Geographers Special Publication 10 (London, 1979) 87-8; Allen, *Enclosure and the yeoman*, 31.

Figure 14. *Farms over 100 acres in Shropshire and the South Midlands 1600-1850 (%)*



Source: Allen, *Enclosure and the yeoman*, 73-4; J.R. Wordie, 'Social change on the Leveson-Gower estates', *Economic History Review*, Vol 27 (1974) 596.

dle ages), but by the mid-eighteenth century a series of largely self-sufficient regional markets were becoming integrated into a truly national market for agricultural products. This integration probably happened first with livestock (since they are easier than grain to move about) but by 1800 it seems that there was a national market for both wheat and barley. This integration was accompanied by changes in the form of marketing. Instead of farmers carting their produce to market they sold their produce to middlemen, initially at the local pub, and by the early nineteenth century through a network of corn exchanges. Growing commercialisation resulted in a changing attitude towards the business of farming which is reflected in contemporary texts. In the late seventeenth century the emphasis was on working with nature, husbanding nature, indeed farming was called husbandry and the majority of farmers were called husbandmen. But by the second half of the eighteenth century farming was called farming, and farmers farmers. Advice in the text books was now about how to make a profit rather than how to husband the land.

In conclusion the English 'agricultural revolution' is defined as an increase in agricultural output and in the productivity of land and labour, accompanied by fundamental changes in agrarian structures. These developments had long antecedents but they are largely a phenomenon of the eighteenth and early nineteenth centuries, when for the first time both land productivity and labour productivity were rising together. Output was raised by increasing the intensity of land use and by yield increases, brought about by more nitrogen for cereals and better fodder

for livestock. Why labour productivity rose is still something of a mystery though it is likely that it was related more to changes in the deployment of the workforce and the amount of energy for farm work, than in conspicuous technological innovation. There were many related changes responsible for the emergence of agrarian capitalism, some of which can be traced back to the sixteenth century, but the driving force behind them was the growing commercialisation of agricultural production.