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THE ALLEGED EXHAUSTION OF THE SOIL IN MEDIEVAL ENGLAND

IN Denton's posthumous volume on *England in the Fifteenth Century*, which was published in 1888, it is suggested that the agrarian changes of the sixteenth century were, at least in part, due to the exhaustion of the soil.¹ This theory has since been developed, and in the hands of its latest exponents has received a more uncompromising form. It is the basis of an interesting article by Dr. V. G. Simkhovitch of Columbia University,² and has been made the subject of an important monograph by Dr. Harriett Bradley of Vassar College.³ More recently Lord Ernle has popularised it in two articles published in the *Journal of the Ministry of Agriculture*.⁴

A few quotations will suffice to show the exact nature of the theory as it appears in the writings of its most recent champions. "The enclosure movement," says Dr. Bradley, "is explained not by a change in the price of wool, but by the gradual loss of productivity of common-field land."⁵ Lord Ernle asserts that the worst feature of the open-field system was "the inevitable and progressive decline in the productivity of the soil." "Strong evidence exists," he says, "to show that in the four-

¹ W. Denton: *England in the Fifteenth Century* (1888). "It was clear at the end of the fifteenth century that the fertility of the arable land of England was well-nigh exhausted" (p. 153). "The returns of wheat and other grain were inconsiderable, and even this was diminishing. The demand for labour in the commercial and manufacturing towns—small as these towns were—forced up the wages of agricultural labourers beyond the means of the farmers. It was this which compelled them to lay down their lands in grass, and to turn their attention to sheep-farming. . . . Much present misery was the consequence. It is well, however, that necessity should have forced on the change. On every side the old arable fields were being converted into sheep pastures, and grazing became the chief occupation of our agriculturists during most part of the sixteenth century. Then the ground had the rest it needed" (pp. 153-4).

² V. G. Simkhovitch: "Hay and History" in the *Political Science Quarterly*, XXVIII (1913).

³ Harriett Bradley: "The Enclosures in England: An Economic Reconstruction" (*Columbia Studies in History, Economics and Public Law*, Vol. LXXX, No. 2, 1918).

⁴ Lord Ernle: "The Enclosure of Open-field Farms" in the *Journal of the Ministry of Agriculture* for December 1920 and January 1921.

⁵ *Op. cit.*, p. 13.

teenth and fifteenth centuries the arable land, continuously cropped for corn for several hundred years, was losing its fertility. The yield was falling. Land which had produced a livelihood for a man and his family ceased to supply his necessary food. Portions were being abandoned as tillage.”¹ His second article contains the following passage :—

“Reliable statistics are not available on so extensive a scale as to demonstrate in conclusive fashion the degree to which the yield had declined. But such figures as can safely be used seem to show that, even on demesne lands, the produce of wheat per acre had fallen from the neighbourhood of 10 bushels in the thirteenth century to between 6 and 7 bushels in the fifteenth century.”²

I venture to think that the available evidence does not support the view of medieval agricultural history which is implied in these quotations. There is, of course, no doubt that the systems of cultivation which were in use during the Middle Ages produced wretched crops and involved great waste of land through frequent bare fallowing, and personally I certainly consider that enclosure was necessary to agricultural progress. But it seems to me more than doubtful whether the defects of medieval agriculture included progressive exhaustion of the soil.

One's suspicions are aroused at the outset by certain inaccuracies and disagreements in the writings of those who advocate the theory of soil exhaustion and by the inadequate and unscientific nature of the evidence which is advanced to prove it. Dr. Simkhovitch, for example, speaks of the soil as being already exhausted in the thirteenth century, and quotes thirteenth-century wheat yields of 4·3 bushels and 5 bushels an acre.³ Lord Ernle, on the other hand, postulates a 10-bushel yield for the thirteenth century and argues for a progressive decline in yield in the two following centuries. In a footnote appended to the sentence in which he speaks of “such figures as can safely be used,” Lord Ernle says : “The yield in 1397 was on the Winchester land 6 bushels, and on the Whitney land 6½ bushels, to the acre. The thirteenth century work on agriculture, known as Walter of Henley's *Husbandry*, calculates the expected yield of wheat per acre at 10 bushels.”⁴ As a matter of fact Walter of Henley is not the author of the estimate which is here attributed to him. The only remarks which Walter of Henley makes about the yield of corn are to the effect that a

¹ *Op. cit.*, p. 838.

³ *Op. cit.*, p. 394 and footnote.

² *Op. cit.*, p. 899.

⁴ *Op. cit.*, p. 899.

crop of *six* bushels of wheat per acre will involve a loss “unless corn sells well.”¹ Apparently Lord Ernle has confused Walter of Henley’s *Le Dite de Hosebondrie* with the anonymous tract called *Hosebonderie*, which is bound up with Lamond’s edition of Walter of Henley. It is true that this anonymous *Hosebonderie* is at least as old as the thirteenth century, that it says “wheat ought by right to yield to the fifth grain,” and that it estimates the seed at from 2 to $2\frac{2}{3}$ bushels per acre. This means a crop of from 10 to 12 bushels an acre. But it is important to notice that such a crop is only what wheat “ought by right to yield” according to an advanced agricultural writer, and that the author of the *Hosebonderie* goes on to speak of the chance of either the spring or the winter sowing being a failure and says definitely “one cannot be sure of the yield above mentioned.” He even alludes to the possibility of the crop being less than the seed sown.² There is really very little reason for supposing that he regarded 10 bushels as an average crop. In any case it is surely very unscientific to make a comparison between a thirteenth-century *estimate* and two crop records of the year 1397 the basis of a sweeping generalisation about the yield of wheat having fallen from about 10 bushels in the thirteenth century to between 6 and 7 bushels in the *fifteenth* century. It would perhaps be if anything more to the point to compare the thirteenth-century statement that wheat “ought by right to yield to the fifth grain” with the assumption of Thomas Tusser (in the edition of 1577) that *one-tenth* of the corn grown should suffice for seed.³ Besides, the use which Lord Ernle makes of

¹ *Walter of Henley’s Husbandry*, edited by Elizabeth Lamond (1890), pp. 18–19. Simkhovitch remarks that Walter of Henley “shows a distinct tendency to exaggerate rather than to underestimate.” *Op. cit.*, p. 394. Maitland says “he represents the ‘high farming’ of his time, and in his two-course husbandry would plough the land thrice over between every two crops.” F. W. Maitland: *Domesday Book and Beyond*, 1907, p. 438.

² *Walter of Henley’s Husbandry* (edited Lamond), pp. 66–7, 70–1.

³ Thomas Tusser: *Five Hundred Pointes of Good Husbandrie* (English Dialect Society, 1878), pp. 136–7. William Harrison (1577) seems to confirm Tusser. He says: “The yeeld of our corne-ground is also much after this rate following. Through out the land (if you please to make an estimat thereof by the acre) in meane and indifferent yeares, wherein each acre of [rie or] wheat, well tilled and dressed, will yeeld commonlie [sixteene or] twentie bushels, an acre of barlie six [? two] and thirtie bushels, of otes and such like [four or] five quarters, which proportion is notwithstanding oft abated toward the north, as it is oftentimes surmounted in the south.” (*Harrison’s Description of England*, edited by F. J. Furnivall, New Shakspere Society, Series VI, Part III. The Supplement, § 1, pp. 133–4.) I do not maintain that these estimates are trustworthy, but only that it is more scientific to compare estimates with estimates and crop records with their like. It is, of course, a far cry from the last quarter of the sixteenth century back to the fifteenth century.

the figures of the year 1397 is also open to criticism. To begin with, the two figures are not independent data. The Witney crop is included in the average figure for the demesnes of the Bishop of Winchester.¹ Secondly, it is surprising that Lord Ernle chooses to compare these fourteenth-century figures with the estimate of the *Hosebonderie* rather than with the earlier figures for the same lands which are given in Dr. Bradley's book. It would have been more pertinent to notice that the average wheat crop on the Winchester demesnes was only $4\frac{1}{3}$ bushels in the year 1208-9, and that at Witney it was only $3\frac{2}{3}$ bushels in that year.² Lastly, neither Lord Ernle nor Dr. Bradley seems to be aware of the hypothetical character of these crop records. The figures are obtained by the process of dividing the total amount of produce by the number of acres sown *in the following season, not in the preceding seedtime*, and are therefore only true on the hypothesis that the acreage under wheat was not altered.³ This fact adds importance to the omission of crops other than wheat from the statistics on which the arguments I am criticising are based.

Of course a theory may be sound though the arguments advanced by its champions are faulty, and I pass to a more general examination of the evidence which bears upon the whole question. The best medieval crop records are derived from a comparison of the seed sown in one year with the crop harvested in the next. Such a comparison eliminates the uncertainties which are produced by local differences in corn measures and in the size of the acre. But except in cases where the comparison was made in the minister's accounts themselves, as occurred at Forncett in Norfolk between 1290 and 1306,⁴ this method of investigation can only be employed when accounts are available for two or more consecutive years. And though no doubt a considerable number of such accounts would be forthcoming if one had time to embark upon the limitless sea of manorial manuscripts, only a few seem to be available in print. In a good many published statistics the figures are given without any

¹ "Whitney" is clearly a misprint for Witney.

² Bradley: *op. cit.*, p. 52.

³ This is frankly recognised in Mr. Hall's edition of the *Winchester Pipe Roll*, from which the figures for 1208-9 are obtained; see Hubert Hall: *The Pipe Roll of the Bishopric of Winchester, 1208-9* (1903), p. xxvi. Dr. Gras also calls attention to the dependence of the Winchester statistics upon this hypothesis; see N. S. B. Gras: *The Evolution of the English Corn Market*, 1915, p. 216, footnote.

⁴ F. G. Davenport: *The Economic Development of a Norfolk Manor*, 1906, p. 29, footnote.

indication whether they are obtained by the more exact method described above or are based, like those of the Bishop of Winchester's demesnes, upon the hypothesis that the area sown in the year covered by the account was approximately the same as that sown in the preceding year. In the following summary of the evidence which I have come across I shall indicate which figures are "exact."

It will be best perhaps to start by collecting the data century by century, in order to see whether the figures seem on the face of them to support the theory of progressive soil exhaustion:—

A. WHEAT.

Place.	Year.	Ratio produce to seed.
Wootton (Oxon) ¹	1278	3
Fornceett (Norfolk) ²	1290	5 (+ 1½ bush.)
" "	1293	4½ (+ 3½ bush.)
" "	1300	5 (- 2 qrs. 7 bush.)
Wistowe (Huntingdon) ³	1298	1½ (+ 8½ bush.)

B. OATS.

Wootton (Oxon) ¹	1278	2½
Basingstoke (Hants) ⁴	1281	2¼ (- 4 bush.)
Fornceett (Norfolk) ²	1290	3 (- 1 bush.)
" "	1293	4 (- 6 qrs. 7 bush.)
" "	1300	3 (+ 5 qrs. 7 bush.)

C. BARLEY.

Wootton (Oxon) ¹	1278	2½
Basingstoke (Hants) ⁴	1281	4¼ (- 4½ bush.)
Fornceett (Norfolk) ⁵	1280	Less than 2½
" "	1290	4 (+ 6 qrs. 3 bush.)
" "	1293	3½ (+ 3 qrs. 4½ bush.)
" "	1300	4½ (+ 5½ qrs.)
Wistowe (Huntingdon) ³	1298	2½ (- 1 qr. 2¼ bush.)

D. PEAS.

Fornceett (Norfolk) ⁶	1290	3 (+ 2 qrs. 2½ bush.)
" "	1293	3½ (- 4 bush.)
" "	1300	6 (- 2 qrs. 7½ bush.)

¹ Adolphus Ballard: "Woodstock Manor in the Thirteenth Century" (*Vierteljahrschrift für Social- und Wirtschaftsgeschichte*, VI, 1908). I am not certain that Ballard obtained his figures by the "exact" method, though many of the accounts he used were for consecutive years, but at Wootton the areas sown with wheat, barley and oats were almost the same in 1277 as in 1278.

² F. G. Davenport: *op. cit.*, p. 30, footnote.

³ N. Neilson: *Economic Conditions on the Manors of Ramsay Abbey*, 1898. The Wistowe accounts are printed in full. I have assumed that Rogers is right in thinking that the "ring" of these accounts, like the coomb of the Eastern Counties, was 4 bushels. This seems almost certain on internal evidence, and it would not affect the ratio much if it were not.

⁴ F. J. Baigent and J. E. Millard: *A History of Basingstoke*, 1889, pp. 633, 636. The interpretation of some of the Basingstoke figures is not free from doubt. I have taken the alternative least favourable to my argument.

⁵ F. G. Davenport: *op. cit.*, p. 29.

⁶ *ib.* p. 31.

1. *The Thirteenth Century*.—In considering the thirteenth-century evidence, it will be well to bear in mind the expectations of the author of the *Hosebonderie*, since Lord Ernle makes his statements about the yield of wheat the foundation of a sweeping generalisation. The author of the *Hosebonderie* says that wheat ought to yield to the fifth grain, oats to the fourth, barley to the eighth, and beans and peas to the sixth.¹ Now the "exact" crop records of the century which I have come across are as in the preceding table (page 16).

It will be noticed that except the Forncett wheat crops and except the Forncett oat crop of 1293 and the pea crop of 1300, all these yields were considerably lower than those expected by the author of the *Hosebonderie*. Probably the crops ought to be increased by one-ninth to allow for the deduction of tithe before the grain was carried to the barn. An allowance for tithe would, however, make but little difference to the yield figures: at Wootton, for example, it would raise the figure for wheat from 3 to $3\frac{1}{3}$. For purposes of rough comparison with the statistics of the next century it may be allowable to take an unweighted average of the yields, ignoring the odd quarters and bushels. This process gives us less than four-fold as the yield of wheat, less than three-fold as the yield of oats, less than four-fold as the yield of barley and rather more than four-fold as that of peas—the exact figures being: Wheat, $3\frac{1}{2}\frac{7}{10}$; Oats $2\frac{3}{4}\frac{7}{10}$; Barley (if we take the yield of 1280 as $2\frac{1}{2}$), $3\frac{1}{2}\frac{5}{8}$; Peas, $4\frac{1}{8}$. The question, of course, arises whether the years to which these figures belong were normal or exceptional years, and perhaps the best test of this is to be found in Rogers' average prices, for we should expect prices to range high after a scanty harvest and low after one that was abundant. Unfortunately, the books from which I have obtained these figures do not, as a rule, make it clear whether the date given is the year of the harvest or the year in which the account was compiled, that is, the year following the harvest whose yield is recorded in the account. But whether, in these uncertain cases, we take the prices of the years given in the table or those of the following years, the averages work out for wheat at something between 6 per cent. and 7 per cent. above the average of Rogers' decennial average prices for the period. For oats the figures are in both cases slightly below the average of the decennial averages, while for barley they exceed that average by about $1\frac{3}{4}$ per cent. in the one case and less than 6 per cent. in the other. The corresponding figures for peas

¹ *Walter of Henley's Husbandry* (edited Lamond), pp. 70–1.
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are less than $1\frac{3}{4}$ per cent. above the average if we take the years given in the table, but nearly 20 per cent. above it if we take the following years. Thus it appears that on the whole the years to which these crop records refer were not untypical of the last three decades of the thirteenth century. Only as regards peas does there seem any likelihood of their being years of abnormally low yield.

For further information about thirteenth-century crops we must turn to figures obtained by the "hypothetical" method mentioned above, and certain other figures as to which I am uncertain whether they were obtained by the "exact" method or not. The following table gives for the principal crops such figures coming within these two classes as I have been able to collect :—

Year.	Places.	Bushels per acre.			Year.	Places.	Bushels per acre.		
		Wheat.	Barley.	Oats.			Wheat.	Barley.	Oats.
1209	Demesnes of Bp. of Winchester ¹	4½	7½	8½	1248	Wootton	2½	9½	7½
1243	Bladon (Oxon) ²	5½	8½	4	„	Cronal (Hants) ³	—	20½	14½
„	Combe (Oxon)	4	3½	4½	1249	Sutton (Hants?) ⁴	6½	16½	13½
„	Handborough (Oxon)	4	5½	5	„	Bladon	6	10½	5½
„	Wootton (Oxon)	5	3½	7½	„	Combe	3½	7½	11
1244	Bladon	6½	7½	12½	„	Handborough	4½	7½	7½
„	Combe	6½	4½	4½	„	Wootton	3	10	4½
„	Handborough	6½	16	9½	1263	Bladon	4	5	4
„	Wootton	6	10	9	1277	Combe	4½	11½	9
1245	Bladon	5	10½	7	„	Wootton	5	6½	8
„	Combe	5½	7	6	1278	Witney (Oxon) ⁵	8½	15½	10½
„	Handborough	6½	10½	9½	„	Combe	5½	5½	6
„	Wootton	4	9½	11½	1282	Handborough	4½	11	7½
1246	Bladon	3½	7½	8½	1283	Handborough	5½	9	7
„	Combe	4	8	7	„	Witney	8½	12	16½
„	Handborough	3½	9½	8½	1284	Witney	10	20	11½
„	Wootton	2½	6	8½	1285	Witney	7½	16	10½
1247	Bladon	5	9½	6½	1289	Combe	7½	17	7½
„	Combe	4	10½	8	„	Wootton	5½	7½	7
„	Handborough	4½	7½	8½	1294	Combe	5½	14	12
„	Wootton	2½	9½	10½	„	Wootton	4½	11	8
1248	Bladon	4½	9½	8	1300	Demesnes of Bp. of Winchester ¹	9	10½	8½
„	Combe	6½	6	6½					
„	Handborough	5	8	11					

¹ Hubert Hall : *op. cit.*, pp. xvi, xlv, xlv. These estates were in the south of England and mainly in Hampshire, the areas being 6838 acres (wheat), 1860½ acres (barley), 7317 acres (oats), and the yield (compared with the seed sown for the following season) 2½ for wheat, 2½ for barley and 2½ for oats.

² All the Bladon, Combe, Handborough and Wootton figures are from A. Ballard : *op. cit.*, p. 459.

³ F. J. Baigent : *The Cronal Records* (Hampshire Record Society, 1891), Part I, pp. 57–8, 67–8. The yield was 5 for barley 3 for oats.

⁴ *Ibid.*, pp. 78, 81–2. Yield, wheat 3½, barley 4½, oats 4.

⁵ The Witney figures are from Ballard's chapter in A. E. Levett and A. Ballard : *The Black Death on the Estates of the See of Winchester* (Oxford : *Studies in Social and Legal History*, Vol. V, 1916), p. 203.

⁶ N. S. B. Gras : *op. cit.*, pp. 263–4. The area was 3353 acres of wheat, 1170½ acres of barley and 3665 acres of oats, and the yields (based upon a somewhat larger area) were : wheat 4, barley 3, oats 2. I have avoided the error which Dr. Bradley has pointed out in Gras's totals. Bradley : *op. cit.*, p. 53.

Many of the figures in this table, and perhaps all of them, depend upon the hypothesis that the area under a given crop was not changed in the seedtime following the harvest to which the crop record refers, but this defect also applies to the figures on which Dr. Bradley and Lord Ernle rely, as does also the uncertainty which attaches to all figures based on acreages because of local varieties in the size of the acre. The author of the *Hosebonderie* says that "acres are not all of one measure," and mentions acres measured by perches of from 16 to 24 feet, and Ballard, in connection with the figures for Bladon, Combe, Handborough, and Wootton, which are included in the table, remarks that "the strips which were called acres, were probably less than 160 poles in extent," and that "the old maps of Oxfordshire, published by the Clarendon Press, show that the customary acre in this county varied from 90 to 120 poles."¹ On the other hand, we read in the *Hosebonderie* that "one can in many places reasonably sow four acres with a quarter of seed, where the land is measured by the perch of sixteen feet and a half," and that "in many places it requires a quarter and a half to sow five acres with wheat, rye, and beans and peas, and two acres with a quarter of barley and oats";² and Ballard tells us that at Wootton and Combe "it was customary to sow 2 bushels each of wheat, barley and peas, and 4 bushels of oats to the acre," and that "the seed sown at Witney was $2\frac{1}{2}$ bushels of wheat to the acre, and 4 bushels each of barley and oats."³—figures which seem to suggest that on these manors the acre did not differ much from the statutory acre. The deduction of tithe is another factor to be remembered.

Taking the figures in the table as they stand, one notices that, of the 45 wheat yields, only 1 (that of 1284 at Witney) reached the figure which the author of the *Hosebonderie* expected and which Lord Ernle considers was the usual yield in the thirteenth century, though an allowance for tithe would bring one other instance (the Winchester demesnes in 1300) up to this standard.⁴ Even if one allows for tithe deduction, it appears

¹ A. Ballard: *op. cit.*, p. 450.

² *Walter of Henley's Husbandry* (edited Lamond), pp. 66-7.

³ A. Ballard: *op. cit.*, p. 448, and A. E. Levett and A. Ballard: *op. cit.*, p. 192.

⁴ The fact that these were ecclesiastical estates does not affect their liability to pay tithe. I am informed by Prof. E. W. Watson that lands which the Bishop of Winchester held as part of the temporalities of the see would pay tithe just as if the land was held by a layman. Monastic lands also paid tithe as a rule, though the Cistercians were exempt on land which they owned *and farmed*, and the military orders also had special privileges in this respect. Land which had once belonged to the privileged orders might continue to be exempt after it had passed into other hands.

that no less than 26 of the wheat crops were less than the 6-bushel standard which Lord Ernle takes as marking the reduced yield of the fifteenth century. As regards barley the figures are even more striking. The author of the *Hosebonderie* expected 32 bushels per acre, and the heaviest crops in the table are one of $20\frac{1}{2}$ bushels at Crondal in Hampshire (1248) and another of 20 bushels at Witney (1284). Even if we assume that the sowing was in every case as light as it was at Wootton and Combe, the ratio of crop to seed must have been less than half that mentioned in the *Hosebonderie* in 9 cases and can only have come up to it in 7. Of the oat crops, only 1 reached the standard of the *Hosebonderie* (16 bushels), and in 15 instances out of the 46 the crop was less than half that standard. In drawing these conclusions I have made allowance for tithe deduction.

But the general implication of the figures can best be shown by an average; and, in order to diminish the influence of possibly exceptional seasons, I have taken an average for each year for which the table contains statistics (adding one-ninth for tithe) and then have taken an average of the resulting figures. The result gives the following average yields for the 18 seasons (of which it should be noticed that 8 belong to the first half and 10 to the second half of the century): Wheat, between $6\frac{1}{4}$ and $6\frac{1}{2}$ bushels per acre; Barley, between $11\frac{1}{4}$ and $11\frac{1}{2}$ bushels; Oats, between $9\frac{1}{4}$ and $9\frac{1}{2}$ bushels.¹

2. *The Fourteenth Century*.—The fourteenth century data, like those of the thirteenth century, had best be divided into two groups according to the method by which the resultant figures have been calculated. And first I shall consider crop records which have been obtained by the “exact” method—

¹ Since the tables for the thirteenth century were compiled I have noticed that some additional figures can be obtained by the “hypothetical” method from the *Fornett Account Roll* of 1273 which is printed in Appendix VIII of Miss Davenport’s *Economic Development of a Norfolk Manor*. The figures are as follows:—

Wheat, nearly 12 bushels an acre.	Ratio of produce to seed, $5\frac{1}{4}$.
Barley, nearly 13 bushels an acre.	Ratio of produce to seed, $2\frac{3}{4}$.
Oats, $18\frac{1}{2}$ bushels an acre.	Ratio of produce to seed, $4\frac{1}{4}$.
Peas, 9 bushels an acre.	Ratio of produce to seed, 4.

These crops are heavy for the period (especially as there was some *curatallum* or small corn of wheat and barley which I have not counted), and their inclusion in the table would tend to raise the average figures. But it appears from the figures in the first table given above that the Fornett wheat yields were exceptionally good, and it is certain that in the Middle Ages the districts most suited to a particular crop must have had less influence in raising the national average than they have to-day. Lack of transport and the prevalence of subsistence farming meant that there was little specialisation of districts in the crops to which they were best suited by soil and climate.

that is to say, by a comparison of the seed sown with the produce garnered in the following harvest. The figures are given in the next table :—

A. WHEAT.

Place.	Year.	Total seed.	Total crop.	Ratio of produce to seed.
Forncett (Norfolk) ¹	1303	—	—	5½ (+ 2 qrs. 6½ bush.)
Ten "Manors" of Merton College, Oxford, in six Southern and Midland Counties ²	1306	—	—	5 (— 4 bush.)
Eleven Manors of Merton College in seven Southern and Midland Counties	1334	165 qrs. 6 bush.	715 qrs. 5½ bush.	4¼ (+ 11 qrs. 2 bush.)
Eleven Manors of Merton College in seven Southern and Midland Counties	1335	154 qrs. 0 bush. 2½ pecks	727 qrs. 2 bush.	4¾ (— 4 qrs. 5 bush.)
Eleven Manors of Merton College in seven Southern and Midland Counties	1336	148 qrs. 3½ bush.	599 qrs. 2½ bush.	4 (+ 5 qrs. 5½ bush.)
Hawsted (Suffolk) ³	1388	16 qrs. 4 bush.	69 qrs. 2 bush.	4¼ (— 7 bush.)
B. OATS.				
Forncett (Norfolk)	1303	—	—	3½ (+ 3½ bush.)
" "	1304	—	—	3½ (+ 3 qrs. 3½ bush.)
" "	1306	—	—	3 (— 3 qrs. 5 bush.)
Seven "Manors" of Merton College in five Southern and Midland Counties	1334	158 qrs. 4 bush.	429 qrs. 7½ bush.	2¾ (— 5 qrs. 7½ bush.)
Eight Manors of Merton College in six Southern and Midland Counties	1335	161 qrs. 2 bush.	498 qrs. 4 bush.	3 (+ 14 qrs. 6 bush.)
Seven Manors of Merton College in five Southern and Midland Counties	1336	154 qrs. 6½ bush.	414 qrs. 6 bush.	2¾ (— 10 qrs. 7½ bush.)
Hawsted (Suffolk)	1388	19 qrs. 3 bush.	40 qrs. 4 bush.	2 (+ 1 qr. 6 bush.)
C. BARLEY.				
Forncett (Norfolk)	1303	—	—	3 (+ 1 qr. 5 bush. 3 pecks)
" "	1304	—	—	4 (+ 3 qrs. 1½ bush.)
" "	1306	—	—	4 (— 2 qrs. 5 bush.)
Eight "Manors" of Merton College in five Southern and South Midland Counties	1334	97 qrs. 4½ bush.	387 qrs. 2¾ bush.	4 (— 2 qrs. 7½ bush.)
Eight Manors of Merton College in five Southern and South Midland Counties	1335	89 qrs. 2 bush.	388 qrs. 2½ bush.	4¼ (+ 9 qrs.)
Seven Manors of Merton College in five Southern and South Midland Counties	1336	92 qrs. 0 bush.	421 qrs. 2½ bush.	4½ (+ 7 qrs. 2½ bush.)
Hawsted (Suffolk)	1388	13 qrs. 0 bush.	52 qrs. 2 bush.	4 (+ 2 bush.)
D. PEAS.				
Forncett (Norfolk)	1303	—	—	4 (+ 1 qr. 2 bush.)
" "	1304	—	—	4 (+ 3 qrs. 1½ bush.)
" "	1306	—	—	2 (— 1 qr.)
Seven "Manors" of Merton College in five Midland and South Southern Counties	1334	12 qrs. 6½ bush.	83 qrs. 1 bush.	6½ (+ ¾ bush.)
Seven Manors of Merton College in six Southern and Midland Counties	1335	28 qrs. 3½ bush.	125 qrs. 1½ bush.	4½ (— 2 qrs. 6 bush.)
Seven Manors of Merton College in six Southern and Midland Counties	1336	21 qrs. 6½ bush.	79 qrs. 5½ bush.	3¾ (— 2 qrs. 0½ bush.)

¹ All the Forncett figures come from F. G. Davenport : *op. cit.*, pp. 29–31.

² The figures for the Merton College manors are calculated from the tables in J. E. Thorold Rogers : *A History of Agriculture and Prices*, Vol. I (1866), pp. 38–45.

³ The figures for Hawsted come from Sir John Cullum : *History and Antiquities of Hawsted and Hardwick in the County of Suffolk* (2nd edition, 1813), pp. 215–19.

The statistics in the above table yield the following figures as the (unweighted) averages of the yields shown in the fifth column: Wheat, $4\frac{5}{8}$; Oats, $2\frac{1\frac{3}{4}}{8}$; Barley, $3\frac{2\frac{7}{8}}{8}$; Peas, $4\frac{1}{8}$. It will be noticed that the figure for wheat is considerably larger, and that the figures for oats and barley are slightly larger than the corresponding figures for the thirteenth century. Peas show a slight decline.

The test of Rogers' prices seems to indicate that the seasons to which these crop records belong were on an average rather more abundant, except perhaps in the case of oats, than were the various decades to which they belong taken together. But the most notable sign of the seasons being super-normal is the fact that the average price of wheat for the various years taken together was nearly 12 per cent. below the average of the decennial average prices for the decades to which those years belong, and this difference depends on the assumption that the dates of the Forncett figures are the dates of the rolls, not the dates of the harvests. If we assume the contrary, the difference in price is reduced to less than 2 per cent. On the whole the evidence does not seem to me to suggest that the years of the crop records were sufficiently abnormal to invalidate the comparison made above between these records and those of the preceding century.¹

The table on page 23 gives fourteenth-century figures which have been obtained by the "hypothetical" method mentioned above, or as to which I am uncertain whether they are "exact" or "hypothetical."

A comparison of this table with the corresponding table for the thirteenth century shows (i) that in 4 cases the wheat crop, in 6 cases the barley crop, and in 1 case the oat crop was heavier than the heaviest crop of the kind in the thirteenth-century table; (ii) that only in 15 instances out of 35 was the wheat crop less than 6 bushels, whereas of the 45 wheat crop records of the earlier table no less than 31 failed to reach that figure; (iii) that, as regards barley, 12 crops out of 36 were under 10 bushels in the later period as compared with 26 crops out of 45 in the thirteenth century; but (iv) that in the case

¹ Besides the statistics given in the table, "exact" figures are also available from Hawsted on an acreage basis for the harvest of 1390. They are: Wheat, nearly 6 bushels an acre; Barley, $12\frac{3}{4}$ bushels; Oats, nearly 5 bushels; Peas, $12\frac{1}{2}$ bushels. The fact that the price of wheat in 1391 was, according to Rogers, 5s. $5\frac{1}{2}$ d., while the average prices were 5s. 2d. for the decade 1381-90 and 5s. 3d. for the decade 1391-1400, seems to suggest that the harvest of 1390 was somewhat scanty. In 1388, however, the crop of peas at Hawsted was less than $7\frac{1}{2}$ bushels an acre.

of oats 18 crops out of 34 fell short of an 8-bushel standard in the fourteenth century as compared with 20 crops out of 46 in the earlier period. In making these comparisons I have taken no account of tithe deduction. In order, however, to obtain average figures comparable with those which were calculated from the corresponding table for the thirteenth century, I have added one-ninth for tithe, taken an average for each year for which there are figures, and then have taken an average of the resulting figures. The following is the result: Wheat, between $7\frac{1}{2}$ and $7\frac{3}{4}$; Barley, between $15\frac{1}{4}$ and $15\frac{1}{2}$; Oats, between $8\frac{1}{2}$ and $8\frac{3}{4}$ bushels. As compared with the corresponding thirteenth-century figures

Year.	Place.	Bushels per acre.			Year.	Place.	Bushels per acre.		
		Wheat.	Barley.	Oats.			Wheat.	Barley.	Oats.
1305	Combe (Oxon) ¹	$3\frac{1}{2}$	$3\frac{3}{4}$	7	1348	Witney	$6\frac{1}{2}$	$21\frac{1}{2}$	$10\frac{1}{2}$
1306	Wootton (Oxon)	4	5	5	"	Brightwell	25	10	$10\frac{1}{2}$
"	Combe	$4\frac{1}{2}$	5	7	"	Downton	$3\frac{1}{2}$	$10\frac{1}{2}$	16
1307	Wootton	5	$5\frac{1}{2}$	$3\frac{3}{4}$	1349	Witney	$4\frac{1}{2}$	8	$6\frac{1}{2}$
"	Combe	$6\frac{1}{2}$	6	6	"	Downton	$5\frac{1}{2}$	10	$8\frac{1}{2}$
1316	Wootton	$4\frac{1}{2}$	6	$4\frac{1}{2}$	1350	Witney	$5\frac{1}{2}$	10	8
1333	Cuxham (Oxon) ²	7	$6\frac{1}{2}$?	"	Brightwell	$9\frac{1}{2}$	16	$7\frac{1}{2}$
"	Eight Manors of				"	Downton	$9\frac{1}{2}$	11	$11\frac{1}{2}$
"	Merton College in				1351	Witney	$6\frac{1}{2}$	$11\frac{1}{2}$	—
"	five Southern and				"	Brightwell	$8\frac{1}{2}$	20	—
"	South Midland				"	Downton	$4\frac{1}{2}$	13	$9\frac{1}{2}$
"	Counties ³	11	20	12	1352	Witney	$4\frac{1}{2}$	7	$4\frac{1}{2}$
1340	Witney (Oxon) ⁴	$5\frac{1}{2}$	$15\frac{3}{4}$	$7\frac{1}{2}$	"	Brightwell	$8\frac{1}{2}$	17	2
1341	Witney	7	$20\frac{1}{2}$	$8\frac{1}{2}$	"	Downton	14	8	9
1342	Witney	6	18	6	1353	Witney	5	8	8
1346	Witney	$5\frac{1}{2}$	$19\frac{1}{2}$	17	"	Brightwell	$13\frac{1}{2}$	$29\frac{1}{2}$	$2\frac{1}{2}$
"	Brightwell (Berks)	$10\frac{1}{2}$	$25\frac{1}{2}$	$5\frac{1}{2}$	"	Downton	7	12	$7\frac{1}{2}$
"	Downton (Wilts)	$5\frac{1}{2}$	14	8	1387	Hawsted (Suffolk) ⁵	8	$16\frac{1}{2}$	$8\frac{1}{2}$
1347	Witney	$6\frac{1}{2}$	$20\frac{1}{2}$	8	1397	Demesnes of the Bp.			
"	Brightwell	$6\frac{1}{2}$	28	$5\frac{1}{2}$	"	of Winchester ⁶	6	15	10
"	Downton	$3\frac{1}{2}$	10	$8\frac{1}{2}$					

¹ The figures for Combe and Wootton are from Ballard: *op. cit.*, p. 459.

² These figures are calculated from the roll printed in J. E. Thorold Rogers: *op. cit.*, Vol. II (1866), pp. 617-30. The hypothetical yields were: Wheat, $3\frac{1}{2}$; Barley, 2.

³ These figures are calculated from the tables in J. E. Thorold Rogers: *op. cit.*, Vol. I, pp. 38-9. The number of manors are those for which wheat figures are available. The hypothetical yield averages are: Wheat, $5\frac{1}{2}$; Barley, $5\frac{1}{2}$; Oats, $3\frac{1}{2}$.

⁴ The figures for Witney, Brightwell and Downton are from Levett and Ballard: *op. cit.*, pp. 203, 210, 216.

⁵ The figures for Hawsted are calculated from those given in Cullum: *op. cit.*, pp. 215-19.

⁶ These figures are calculated from the tables in Gras: *op. cit.*, pp. 267-8. The areas were: Wheat, $2366\frac{1}{2}$ acres; Barley, $1302\frac{1}{2}$ acres; Oats, $1660\frac{1}{2}$ acres. The yields were: Wheat, 3; Barley, $3\frac{1}{2}$; Oats, 2. Besides the figures in the table "hypothetical" yields are available for a few years for Wistowe, Huntingdonshire, viz.: Wheat, $1\frac{1}{2}$? (1307), $4\frac{1}{2}$ (1311), $7\frac{3}{4}$ (1316), 3 (1318?); Barley, $5\frac{1}{2}$ (1307), $3\frac{1}{2}$ (1311), $3\frac{1}{2}$ (1318); Oats, $3\frac{1}{2}$ (1307), $1\frac{1}{2}$ (1311), $1\frac{1}{2}$ (1318?), 2 (1351), less than 1 (1368). But I suspect that sheaves of oats fed to stock were not counted. These figures are calculated from Neilson: *op. cit.*, *passim*.

these show an increase of over 1 bushel for wheat, an increase of 4 bushels for barley and a decrease of about $\frac{3}{4}$ of a bushel in the case of oats.

3. *The Fifteenth Century*.—For the fifteenth century neither Lord Ernle nor, I think, Dr. Bradley quotes any figures at all, and statistical evidence of this period is certainly hard to come by. For one thing, scholars have paid less attention to the fifteenth-century account rolls than they have to those of earlier date. The thirteenth-century accounts have attracted attention because they are the earliest we possess, and the fourteenth-century accounts have interested historians because of the light they throw upon the effects of the Black Death and the Revolt of 1381. But in any case a fifteenth-century minister's account is liable to be deficient in figures bearing upon the yield of the crops. It was becoming increasingly common to let the demesne to tenants, and when the land was dealt with in this way the lord's bailiff was no longer interested in keeping an account of the crops.

It may, however, be worth while to set forth the fragments of evidence which I have been able to collect. The first is some figures relating to Adisham in Kent which come from a document in the archives of Canterbury Cathedral. This document is, unfortunately, undated, but Thorold Rogers says it "is certainly to be assigned to the middle of the fifteenth century." And Rogers tells us that it shows the rate of production per acre to have been: Wheat, 12 bushels; Barley, 16 bushels; Oats, 20 bushels.¹ It will be noticed (a) that these figures are all larger than the average figures both of the thirteenth and the fourteenth centuries; (b) that the crops of wheat and oats exceed the largest in the thirteenth-century table and are only surpassed by two fourteenth-century wheat crops; (c) that the barley crop is only exceeded by 4 thirteenth-century and 14 fourteenth-century crops. The second piece of evidence is that supplied by the Account Roll of Ansty in Hertfordshire which is printed in the Appendix to the first volume of Cunningham's *Growth of English Industry and Commerce* and belongs to the year 1402, so that the harvest of which it tells us is that of 1401. The application of the "hypothetical" method to this document gives the following figures: Wheat, between $8\frac{1}{4}$ and $8\frac{1}{2}$ bushels per acre; Barley, between $26\frac{1}{2}$ and $26\frac{3}{4}$ bushels; Oats, between $9\frac{1}{4}$ and $9\frac{1}{2}$ bushels; Peas, between $6\frac{3}{4}$ and 7 bushels. Wheat, barley and oats were thus superior to the averages

¹ J. E. Thorold Rogers : *op. cit.*, Vol. IV (1882), p. 39.

of the thirteenth and fourteenth centuries.¹ The ratio of produce to seed was, however, less than 3 in the case of peas—a figure considerably poorer than the average figures for the preceding centuries. Lastly, an account roll of Wistowe in Huntingdonshire, which probably, but not certainly, belongs to the year 1466, contains particulars (on the “hypothetical” basis) of a barley crop of over 23 bushels (with 5 as the return of produce to seed), which is larger than any barley crop in the thirteenth century table and considerably above the average for the fourteenth century. As regards the character of the seasons it should be noticed that wheat and barley prices were abnormally high in 1402, and that prices in 1467 seem to indicate that the barley harvest of 1466 was little if at all above normal.

Before an attempt is made to summarise the conclusions which are suggested by all this evidence a word must be said about another method of testing the information which bears upon the theory of soil exhaustion. No doubt one of the best tests would be to compare the average yields of the same manors for the thirteenth and fourteenth centuries. This method would eliminate uncertainties which spring from differences in the size of the acre and in the original fertility of the soil as between place and place, and, if records for a sufficient number of seasons could be obtained, the influence of abnormal seasons would be discounted. But data are not available in print for an adequate application of this test. Dr. Bradley attempts to apply it in the case of Witney, but she fails to recognise that some, and possibly all, the Witney figures are “hypothetical,” and she only applies the method to the case of wheat. It is true that the oats at Witney, as well as the wheat, show a fall in the fourteenth century as compared with the thirteenth century (from an average of about 13 bushels to one of not quite 9 bushels); but the significance of these figures is reduced by the fact that the barley average slightly improved, being between $14\frac{1}{2}$ and $14\frac{3}{4}$ bushels in the later and almost exactly $14\frac{1}{4}$ bushels in the earlier century. In any case Witney is only one manor.

In regard to the problem as a whole I wish to emphasise the fact that I do not profess that the evidence I have brought forward is adequate to prove, or even to make probable, any positive conclusion. I am not prepared to maintain that the yield of corn improved or even remained steady in the later Middle Ages. All I contend is that until much stronger evidence is forthcoming

¹ That is, if one-ninth is added for tithe to make the figures comparable. But I feel uncertain about my interpretation of the entry regarding oats.

than that provided by Lord Ernle and Dr. Bradley, it is quite unscientific to conclude that the open field farms did decline in fertility in the fourteenth and fifteenth centuries. For the indirect evidence cannot easily bear the construction put upon it. It is suggested by Lord Ernle that in the later Middle Ages the poorer land "dropped out of arable cultivation because it no longer produced enough to make tillage profitable," and that "land which had produced a livelihood for a man and his family ceased to supply his necessary food."¹ But surely, unless the population declined, a diminution in the fertility of the soil would tend, in a self-supporting country, rather to produce an increase than a restriction of the arable area. And if the population declined—if the reduction of population by the Black Death was not rapidly made good—then the most obvious explanation of the conversion of arable to grass would seem to be the diminished demand for bread-stuffs. The new theory is so hard to reconcile with the facts of general economic history. If men found it harder to get food because of the exhaustion of the soil, how can we explain the expansion of industries such as cloth-weaving which did not increase the food supply? Is there any evidence of considerable and increasing importation of food-stuffs from abroad? If food did come from abroad, how is it that the open fields of the continent were able to supply it? Why did not they, too, suffer from this process of soil exhaustion? And why did wages in England rise? How was it that the amount of wheat which the agricultural labourer's wage would buy increased so enormously between 1300 and 1500? If the peasant's holding was no longer able to supply him with as much food as it formerly did, he would surely have dragged wages down by his urgent need of part-time employment as a wage-earner.

Thus the indirect historical evidence, like that which directly bears upon the question of yield, does not even point in the direction which the theory of soil exhaustion seems to require. And apart from historical facts the theory is on the face of it anything but probable. It is as hard to reconcile it with what we know of the processes of soil exhaustion as it is to fit it into the general framework of English economic history. On heavy land a bare fallow every third year would probably be sufficient to maintain fertility. Moreover, the arable did receive some manure in the Middle Ages, and some of it was cultivated on the two-field system and was fallowed every other year. Finally, if the fertility of the soil was reduced, is it likely that the course of events would

¹ Lord Ernle : *op. cit.*, pp. 838, 899.

have been such as Lord Ernle supposes? The arable was not virgin soil in the thirteenth century: probably the greater part of it had been under the plough for many hundred years. If, then, the yield was 10 bushels of wheat per acre in the thirteenth century and thereafter declined, we must either suppose that the crops were incredibly large, say, at the time of the Norman Conquest, or else that the system only began to exhaust the soil after giving stable or increasing returns for several centuries. But the Rothamsted experiments in continuous cropping seem to indicate that the tendency of an exhausting system of cultivation, at least in the case of wheat, is to reduce the crop to a minimum in a few decades, but that this minimum, once it is reached, can be maintained almost indefinitely. A plot at Rothamsted has been under wheat every season for 78 years without receiving any manure: the crop diminished rapidly in the first 30 years; but Sir Daniel Hall (then Mr. A. D. Hall), writing in 1905, said: "All the evidence seems to point to the fact that this plot, which has been without manure of any description since 1839, has reached a stationary condition, and that the average crop of $12\frac{1}{2}$ bushels for the last 40 years will in future diminish very slowly, if at all."¹

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¹ A. D. Hall: *The Book of the Rothamsted Experiments*, 1905, p. 37. The case of barley is somewhat different, and Sir Daniel Hall, speaking of the plot on which barley has been grown for the past 70 years, says: "On the whole, the results point to the probability that unmanured land will become unable to grow barley continuously at a much earlier date than will be the case with wheat, so comparatively restricted is the range of the barley roots," *op. cit.*, p. 76. But though the crop of barley has declined continuously from decade to decade, a decline in the later decades also took place on the manured plots, and I notice that the steepness of the curve which shows the decline on the unmanured plot is less for the later decades (when the dunged plot was also declining in yield) than it is for the earlier period when the crop on the dunged plot was increasing. These facts seem to indicate that the tendency to stability is not peculiar to wheat. I am indebted to Professor Somerville for valuable information in regard to these experiments.