



# AGRARIAN REVOLUTIONS : MYTH OR REALITY?

*Adriaan Verhulst*

The contribution of an agrarian historian to the memory of the famous historian and philosopher of science George Sarton has to discuss, if only by way of introduction, the fundamental problem of the historical relation between science and practice, in this case the relation between agronomy and agricultural technique. According to the well known philosopher of science John Ziman, the interrelation of theory and practice cannot be caught within a simple theoretical model. (1) In his opinion a technique sometimes precedes science, in other cases some aspects of technical knowledge find their origin in close relation to parallel evolutions in pure science. Practice and theory, as the examples related to biology and genetics cited by Ziman prove, can lead separate lives until one day they happen to meet with good results.

The historian of agriculture can contribute to this debate and formulate new hypotheses concerning the relation between agronomy and agricultural techniques. We will try to prove that, before the nineteenth and twentieth centuries, so-called agrarian revolutions not only did not result from the science of agronomy but that they never even existed, not in the Middle Ages, nor in the eighteenth century.

## I

The first part of our thesis, namely that agronomic literature had little or no influence on the common practice of farming and on agricultural technique in general, is usually admitted, at least as far as the period before the origin of agronomy as a science is concerned. This is before the middle of the eighteenth century when

problems of agronomy were first discussed in the academies of different countries. It is possible that the presence of important Latin agricultural treatises like those of Cato Senior, Varro and especially of Columella in several monastic libraries during the early Middle Ages led on some large estates or in the garden next to the monastery to experiments which at that moment had no further influence or application. The French historian Duby however, whose views on agricultural revolution in the Middle Ages will be treated below, is less sceptical about the influence of these Latin works on agricultural practice in general (2). He ventures to suppose that the study of these texts by some monastic administrators in Carolingian times can have been one of the impulses to medieval agrarian expansion. Thinking along these lines, Duby considers the appearance of original treatises on estate management and agricultural technique at the time of the important agrarian expansion of the twelfth and thirteenth centuries, particularly in England and Italy after 1250, as highly significant (3). One of the earliest of such treatises was written between circa 1276 and circa 1290 in the Norman-French vernacular by a certain Walter of Henley (4). Its purpose was the instruction of both secular and ecclesiastical bailiffs on large manors. Therefore it contains more information concerning the administration and organization of such manors than it provides agricultural advice. The same is true of the few other works from England in the same period, which were also mostly written in French (5). The work of the patrician and landowner Pier de 'Crescenzi (Petrus de Crescentiis) of Bologna entitled "*Ruralium commodorum libri XII*", had a far larger audience. This was mainly the consequence of the fact that it was printed in 1471 at Augsburg, more than one and a half century after it had been written. It was written between 1300 and 1309 in Latin but shortly afterwards translated into Italian (6). de 'Crescenzi abundantly cited classic agronomists, especially Columella, whose quotations however he knew only indirectly through Palladius, who in the fourth century using Columella's material (7) composed a manual in the form of a calendar. de 'Crescenzi's work also contains some agronomic advice based on his own experience. This work (translated into German even before the end of the fifteenth century) and still more so that of Columella (many manuscripts of which were found in fifteenth century monastic and lay libraries and which was used as a basis for the first German agronomic discourse written

in Latin by Konrad Heresbach in 1570 (8)), had great success in humanistic circles during the late fifteenth and sixteenth centuries. Therefore one can wonder, as Duby quite rightly did this time (9), whether these works really were practical manuals used as such. As long as they have not been thoroughly studied, in order to separate practical experience from compilation as their components and to compare that experience with the techniques actually used in the Middle Ages, we will remain very sceptical about their influence on the agricultural activities of the average contemporary landowner or peasant.

This scepticism is also based on an a fortiori line of argument starting from the agronomic literature of the eighteenth century. It is well known that in this period many more works than before were written on the subject and that most of them were printed. They found their way to a larger public of much less illiterate persons than ever before. Moreover, these agronomic works were published in the second half of the eighteenth century and the beginning of the nineteenth century, the period in which an agricultural revolution is said to have taken place. Although this coinciding in time of both phenomena suggests a causal relation between agronomy and the agricultural revolution, this relation never existed, not only because the agricultural revolution of the eighteenth century is now considered to be a myth, but also, as will be argued below, because the eighteenth and nineteenth century agronomists had very little influence on agricultural practice, if ever they had any. As Michel Morineau formulated it : "<les agronomes> n'ont pas fait la "révolution agricole" mais ils l'ont proclamée; d'où la double confusion qu'elle ait eu lieu et qu'ils en soient les auteurs" (10). The same view is held by the well-known Dutch historian of agriculture Slicher van Bath (11) and it is also the conclusion of André Bourde in his important tripartite standard work on agronomy and agronomists in eighteenth century France. We will continue to refer to the latter work because the subject-matter is too elaborate and the authors are too numerous (12). Bourde argues (13) that the agronomic literature of the eighteenth century, describing the prototypes of the so-called "Modern Husbandry" serving as models and propaganda, was in many cases the product of laboratory experiments. This does not exclude that data based on experience were incorporated.

The effect on agricultural practice according to Bourde was slight. Only later on, in the nineteenth century, did the agronomic movement of the eighteenth century really influence agriculture as a result of admiration and praise by early nineteenth century agronomists. One of them was Nicolas François, named de Neufchateau, who in 1804 procured a new edition of Olivier de Serres' *Théâtre d'Agriculture* which dated back to the sixteenth century. In his introduction to this new edition, de Neufchateau prophetically pointed out the course along which agronomy could make its influence felt on agricultural practice when he wrote : "La chimie, qui promet beaucoup et qui tiendra parole, n'avait pas encore soumis à l'analyse les principes reproductifs des engrais naturels et artificiels" and "la mécanique, qui associe les forces de la nature à celle de l'homme, était encore loin de la perfection vers laquelle elle marche" (14).

How this scientific and technological progress, especially during the second half of the nineteenth century, found its way to the peasantry has been described in an excellent manner by J. Craeybeckx (15). According to him its success was caused by the rapidly expanding agricultural instruction as well as by the frequently attended evening courses and lectures organized by the official agricultural committees ("comices") and especially by free agricultural societies.

## II

Because in the eighteenth century agronomy was still very abstract, hardly scientific and impractical, the above mentioned conditions for its vulgarization were not yet fulfilled. For this reason it is impossible to suppose that agronomic works of that period were at the basis of the progressive agricultural techniques used in some regions of Western Europe. These techniques, noticed, described and praised by some intellectual of the eighteenth century, were wrongly labelled as the manifestation of the agricultural revolution of the eighteenth century by later economists and historians.

The expression "agricultural revolution" was first used more than a hundred years ago (16) to indicate the fundamental changes

in the English countryside during the eighteenth and the beginning of the nineteenth centuries. These changes mainly consisted of the disappearance of the openfield system as a consequence of the abolition of collective servitudes weighing on it (especially the grazing of the fallow). They completed the enclosure movement which had already started in the late Middle Ages and gave the English landscape its typical character (17). To indicate the important alteration of proprietary rights and land use caused by this process, Karl Marx was one of the first to use the term "Agrarian (not "Agricultural") Revolution" (18). He probably did so on the analogy of the expression "Industrial Revolution", with which the former was connected in a causal and chronological way. On the other hand, according to Marx and other earlier authors, the "agrarian revolution" coincided with the introduction of new farming techniques imported to England from Flanders. Among the latter the disappearance of the fallow by the sowing of fodder-plants, such as turnips and clover, was the most spectacular (19).

Ever since most historical studies on the evolution of agriculture have been more interested in the introduction and spread of new agricultural methods than in the consequences of these technical innovations, such as the increase of the agricultural output and productivity (20).

For the historian it is indeed easier to trace in the sources the appearance of agricultural innovations than to study their often slow spread and generalization in time and space and to measure their effect on agricultural output and productivity on a quantitative basis (21). Agricultural revolutions can only be labelled as such by paying close attention to technical innovations, but doing so the interval between their first mention and their generalization is often neglected. If one looks at the problem from an economic point of view one is even less inclined to speak of "revolutions" because the increase of the output was not always, and sometimes not in the first place, consequence of technical innovations. For both reasons it is dangerous and confusing to speak of "agricultural revolutions". In our opinion, they are rather myths than reality.

This point of view will be explained below by summarizing the

modern opinions about the so-called revolutions that are said to have taken place since the introduction of agriculture about 6000 years ago, especially during the Middle Ages and the eighteenth century. We will of course not take into consideration the only true agricultural revolution which according to modern insights is deserving that name, i.e. the one taking place at an accelerated pace since the middle of the nineteenth century and which is still going on now. It is characterized by an enormous progress in biology (use of chemical fertilizers, introduction of insecticides and herbicides, selection methods) and by the mechanization of the production process (22).

### III

The so-called "agricultural revolution" in eighteenth century England pointed out by Marx and others after him, is the earliest one mentioned in historiography. But for a long time it was accepted that in the eighteenth century an agricultural revolution also took place in France and especially in the Southern Netherlands. Moreover a relation was seen in this respect between these three countries. The interest of foreign experts was above all excited by the "New Husbandry" of the Southern Netherlands, which was in fact limited to the territory of the present-day East and West Flanders and the neighbouring areas in modern Northern France (French Flanders and the surroundings of Lille) and in Hainault (23) where the so-called Flemish agriculture was in use.

Already in 1650 the work of Sir Richard Weston, "A Discours of Husbandrie used in Brabant and Flanders" was published by Samuel Hartlieb (24). Crop rotation systems and manuring methods used in the Land van Waas, in the north-east of Eastern Flanders, are its main topics. It was however only during the late eighteenth and the beginning of the nineteenth century that the whole of Western Europe became acquainted with the Flemish "New Husbandry" by the writings of travellers, scientists and agronomists, such as I. Thys (1788), abbé Mann (1735-1809), Nicholas François de Neufchateau (1804), J.N. Schwerz (1807-1811), John Sinclair (1815), Thomas Radcliff (1819) a.o. (25). They drew attention to the abolition of the winter fallow, the introduction of new crop rotation

systems in which the potato took an increasingly important place, the cultivation of so-called double-crops on the short fallow ("cultures dérobées") and especially to the introduction of fodder-plants such as turnips, clover and spurry in the crop rotation which made stable-feeding possible and increased manure production. In recent years Chris Vandebroek of Ghent University disproved that these innovations could have provoked an agricultural revolution causing an important increase in agricultural output and productivity (26). He did not only show that the distribution of the potato in the Southern Netherlands was a very slow process which took place from the west to the east (the potato first appeared in the extreme West of Western Flanders at the end of the seventeenth century, to reach Limburg only around the year 1770). He also stressed that the cultivation of potatoes was a "culture de misère" proving the incapability of agricultural techniques to increase corn production in proportion to the growth of the population (the so-called "Irish development"). Proving this thesis with statistic material Vandebroek for the period 1776-1785 only accepts a maximal increase of the corn output of 30 to 35 percent compared to the middle of the seventeenth century. If one considers the yield ratios only there even was no increase of agricultural productivity at all. The level of productivity had remained almost stable during the four centuries preceding the middle of the nineteenth century. It is therefore out of question that an agricultural revolution took place before that date. On the other hand some innovations which already during the seventeenth century but especially towards the end of the eighteenth century were considered by the above mentioned agronomists to be of recent origin, in reality date back to well before the end of the Middle Ages. Most of these medieval innovations, as will be shown below, concern the reduction of the short and the winter fallow through the cultivation of fodder-plants and plants grown for commercial purposes. In the second half of the seventeenth century, and perhaps even earlier, in the last decades of the sixteenth century, they were introduced in England (27). It is here that Karl Marx made an "agrarian revolution" precede an industrial revolution to account for the rise of an industrial proletariat in the eighteenth century. The classic work of Lord Ernle on English agriculture (1912) is mainly responsible for the first and longest accepted picture of this so-called agricultural revolution (28). According to Ernle, the introduction of new agricul-



tural techniques was impossible as long as the *openfield* with its common grazing after the harvest (the so-called "common land") prevailed. When Parliament did away with the "common field system" and replaced it by "enclosures", progressive landowners and tenant-farmers, especially in Norfolk, introduced according Ernle new farming techniques like the cultivation of turnips during the fallow period and of clover and other fodder-plants which were incorporated in the well-known four-yearly crop rotation system of Norfolk. This phenomenon would have caused important changes in English agriculture between 1760 and 1815.

In the sixties of our century the version of Lord Ernle was gradually abandoned. To deal with all new theories in detail would take us too far, but we will mention the thesis of Eric Kerridge which fundamentally changed the picture painted by Ernle by dating these innovations much earlier, namely at the end of the sixteenth century (29). Other historians of agriculture, like H.E. Hallam, traced some of the symptoms of intensive agricultural techniques in Eastern England back to the thirteenth century (30), a conclusion we are inclined to support with respect to the Southern Netherlands. In the light of these views it is necessary to examine whether the thesis can be maintained that the so-called innovations in English agriculture were introduced from Flanders during the second half of the seventeenth century.

This classic thesis was also defended by the famous French historian and specialist in rural history Le Roy Ladurie in the standard work "*Histoire de la France rurale*", edited by G. Duby and A. Wallon. Relativizing an agricultural revolution in France during the eighteenth century (31), he points to the introduction of intensive agricultural techniques from Flanders especially from the region of Lille into the northern part of France about 1690. The cultivation of vegetables and fodder-plants, stable-feeding, an efficient production of manure and the gradual decline and disappearance of the fallow were at that moment typical of Flemish agriculture. We agree with Le Roy Ladurie in thinking that these agricultural methods had their origin in medieval Flanders (32).

In 1717-18, this "système flamand-lillois", as Le Roy Ladurie calls it, crossed the Somme river and was introduced southwards on the

large openfields of the Paris Basin, where it was put into practice on the large farms typical of that region. The increase of corn production with forty percent between 1715 and 1787, which Le Roy Ladurie sees as a result of these innovations and indeed no longer as a result of a real "revolution", was however strongly contested by historians such as Michel Morineau and Chris Vandembroeke, as we already mentioned above (33).

#### IV

We referred repeatedly to the Middle Ages and the important agricultural changes which are said to have taken place during that period. A lot of historians, such as Duby in 1954, even used the expression "agricultural revolution" to indicate these changes (34). At that time Duby dated it between 950 and 1050, but later on he became less precise (35). The American historian Lynn White even dated this medieval agricultural revolution back to the early Middle Ages, somewhere between the sixth and the ninth century (36). Although there is a chronological gap of several centuries between both theories, Duby and White nevertheless agree with each other that the fundamental changes in agricultural technique took place *before* the late Middle Ages. They consider them as one of the main causes of the population growth and the clearance movement of the eleventh, twelfth and thirteenth century. This view differs widely from the opinion advocated by Slicher van Bath, who set the important changes in agricultural technique in the last two centuries of the Middle Ages, *after* the important agrarian expansion of the eleventh to thirteenth century (37). According to Slicher van Bath, the technical progress in agriculture was the consequence of the late-medieval crisis, when prices of corn fell, labour became scarce and cattle-breeding became more important than the growing of corn. In his view, these changes were the beginning of the "New Husbandry" of the Modern Times (38). In one of our first articles, about thirty years ago, we thought the thesis of Slicher van Bath to be true and we even added new evidence to it (39). In later years however we gradually abandoned this view and after the publication of studies by Derville, Van Uytven, Mertens and Irsigler to which we could add our own research of new source material (40), we realized that the

most important changes in agricultural technique do not have to be looked for in the early Middle Ages nor in the late Middle Ages, but probably in the late twelfth and thirteenth century when the agrarian expansion had reached its height.

At present, we intend to make this view acceptable on the one hand by summarizing criticism on the classical thesis of Duby and White, according to which the indisputable agricultural expansion between the eleventh and thirteenth century was unthinkable without an important progress in agricultural technique (41). On the other hand we will tone down the theory of Slicher van Bath about the improvement of agricultural technique during the late Middle Ages, not only using the already mentioned recent studies on the growth of an intensive husbandry during the thirteenth century (42), but also by appealing to a recent economical explanation proposed by our collaborator E. Thoen, which differs widely from the explanation of the economic "depression" theory of Slicher van Bath. One of the technical innovations of medieval agriculture both Duby and White pointed out is related to the use of the horse, especially as draught animal for cart and plough. The in their view limited possibilities in Antiquity of the harnessing of horses were the result of a flexible yoke pressing on the horse's veins and trachea when pulling great-weights (43). The use of a wooden yoke, resting on the horse's shoulders, together with the general use of the horseshoe, greatly favoured the replacement in many regions of the ox by the horse from the eleventh-twelfth century onwards. Although the pulling power of the horse is not greater than that of the ox, the horse moved faster, it was more mobile and it had more endurance. These qualities must have prevailed over its higher cost, its greater sensibility to diseases, and above all its more expensive feed, which in a large measure had to consist of oats. Moreover, according to these authors, there is a connection between the use of the horse in agriculture and two other innovations of early medieval farming technique, the generalization of the use of the heavy plough with mouldboard and the adoption of the three-course cultivation system. While the light plough tilled the soil only superficially, the heavy plough, with its metal ploughshare, coulter and mouldboard, fitted with a cart and two wheels, cut deeper furrows in the soil (mostly to the right) turning it up so that the soil was more crumbled and

exposed to the air while weeds were more thoroughly destroyed. On account of the slight effect of the light plough on the soil, cross-ploughing was necessary, creating small square fields (the so-called "Celtic fields") or block fields, instead of the long and narrow strips that would have been created by the heavy plough with fixed mouldboard. This implement indeed could not be used for simple up-and-down ploughing, because its fixed mouldboard turned the soil always to the same side, thus preventing the formation of a regular pattern of ridges and furrows. More complicated plough-schemes therefore had to be adopted. In addition, difficult turns of the plough-team at the end of the fields had to be avoided as much as possible. Taking these turns was easier when the plough was drawn by horses than by oxen. In this way, according to Lynn White, the heavy plough contributed to the origin, from Carolingian times onwards, of the typical long strips of arable land of the openfield landscape that was gradually built up from that moment onwards. Such strips could easily be grouped in more or less square bundles of parcels all running in the same direction, known as "furlongs" ("Gewanne" in German). They were generally three or a multiple of three, in order to facilitate the three-course system, which is believed to have been introduced at the same time. The furlongs provided the topographical basis for the three-course system and determined its compulsory character, because all the strips of one furlong had to be sown with one and the same plant and consequently had to be tilled at the same time in the same way. This explains the connection that existed, particularly in the classical view as exposed by White and Slicher van Bath, with the plough-type and field-shape on the one hand, and the introduction of the three-course system as a new crop rotation technique, necessary for the new field-organization, on the other hand (44).

White, who has insisted more strongly than anybody else on the interdependence of all these innovations and who dated them back to an earlier period, moreover believed that the three-course system not only favoured the growing of oats which made the increasing use of horses possible, but also the harvesting of leguminous crops. These crops being rich in proteins improved human nutrition which according to White could explain the population growth from the tenth-eleventh century onwards. The main reason for White, and indeed

also for Duby and all other authors to put an agricultural revolution before the thirteenth century first and foremost, is to explain the great population explosion that can be proved for some regions from the tenth century onwards and almost everywhere in Europe during the eleventh century.

It is well known that this population growth not only made the rise of great cities in Western Europe possible, but also occasioned a great movement of land reclamation with the result that in the European landscape cultivated land became much more important than woodland.

All this was, according to the classical view which was best represented by Duby and White and which we explained above, considered impossible without far-reaching changes in agricultural practice. Moreover, the important increase in soil productivity was not only seen as a consequence of all these agricultural innovations but as an aspect of the agricultural revolution itself. In their opinion, indeed, productivity must have been extremely low in Carolingian times, so low that in most years half and in some exceptional years even the whole of the harvest had to be put aside for seed. In the thirteenth century, on the contrary, harvests probably yielded on an average four times the volume of seed used for them. In round figures this would mean a rise of yield-seed ratio's from 1,5 : 1 and 2 : 1 in Carolingian times to 4 : 1 in the thirteenth century. The very low productivity figures from the Carolingian period put forward by Duby (45), provoked a controversy soon after their publication, that was in inverse proportion to the available documentation (46). This controversy started off the criticism on other aspects of the so-called early-medieval agricultural revolution. First of all, Duby's calculations of soil-productivity were contested because they resulted in the very low figures quoted above and because they do not tally with other figures discovered and calculated since (47). These recent figures result in yield-seed ratio's of 2 or 3 : 1 for the ninth and tenth centuries, and of 3 to maximum 4 : 1 on average for the twelfth and thirteenth centuries. This would mean that a general and continuous rise of soil productivity from the ninth to the thirteenth century is almost out of the question. At most, there was a limited and moderate increase, certainly not sufficient to keep

up with the growing demand, that had to be met mainly by extensive reclamation of new land. Although these newly produced figures can be accepted as an average for most European regions, a few very densely populated and highly urbanized regions in North-West Europe, such as the above quoted very fertile loamy region around Lille, show much higher yield-seed ratio's for the end of the thirteenth and the beginning of the fourteenth century (48). In our opinion, these figures however are exceptional (49) and must be interpreted as the result of an intensification of Flemish agriculture, the origin of which must certainly not be dated long before the beginning of the thirteenth century, as we will see further down.

The extensive character of land reclamation from the tenth to the thirteenth century and the very moderate rise in soil productivity during this same period, give way to the idea that there has been no great qualitative progress in agricultural technique before the thirteenth century, let alone an agricultural revolution.

A recent thorough examination of illustrations and texts from the second and third centuries A.D. concerning the harnessing of horses in Northern Gallia has shown that the old way of harnessing horses was not as harmful as was impressed upon us on account of the studies of Lefebvre des Noëttes (50). The same study proved that in the second and third centuries A.D. the prosperous farmers of Northern Gallia had used horses more frequently and for heavier loads than was hitherto believed with respect to North-West Europe—on the basis of evidence concerning the Mediterranean world where indeed asses and mules were preferably used in agriculture. The progressive use of horses in West-European agriculture from the eleventh-twelfth century onwards was not only limited to some regions, it was also determined by other than pure technical considerations, like the size of the farms, the development of estates etc. This explains why in many regions of Western Europe, particularly in traditional corn growing regions, the ox continued to be used as draught animal until the nineteenth or twentieth century (51).

The distribution of the heavy plough was not a linear and general consequence of a single invention either (52). Although it was rare before the eleventh century, this type of implement was not unknown in late Antiquity and was used by the Slaves and the East-Frisians during the early Middle Ages. Moreover, during the last

three centuries of the Middle Ages different types of heavy ploughs were used. A new type of plough with mouldboard but without wheels was used in England and on the Continent from the thirteenth century onwards until well after the Middle Ages (53). Therefore one is forced to take into account, as one had to do in the case of the horse, the part played by more complex factors, mainly of social and economic nature, in the distribution of plough-types and also to disconnect the problem from the origin of field-forms (54).

From the more differentiated conclusions of recent research concerning the use of the horse and the heavy plough in medieval agriculture, one may infer rightly that their connection with the spread of the three-course system is not as direct as some historians and geographers have supposed. Recent research proves beyond doubt that a kind of three-course system was applied on some fields of several large domains in Northern France during the Carolingian period. Topographically these fields formed vast units, called *culturae*, very often grouped in a multiple of three (55). This situation however was exceptional. It was indeed not until the eleventh-twelfth century that in many regions of North-West Europe the rather small and isolated fields of a village were joined together to form one vast openfield complex, named also "cultura", "kouter" or "couture" (< lat. cultura) (56). More northwards, in the eastern parts of the Netherlands and in North-West Germany, these fields were called "es(ch)" or "enk" (57). At the same time of the creation of the one vast "cultura" or shortly afterwards, at the latest during the twelfth or early thirteenth century, more and similar "culturae", won by the reclamation of new land, were added, as far as geographical conditions were favourable. Together with the original and oldest "cultura" they formed a unit of three fields nearly equal in size, that occupied the main and best part of the arable of the village (58). In some regions, though certainly not in all (59), a compulsory three-course system probably replaced a possibly already pre-existing but voluntary three-course crop rotation. This may have happened as a result of pressure exerted by large landowners or because of a kind of forced land redistribution (60). Elsewhere, the three-course rotation continued to exist but was increasingly infringed upon. The same was true for some regions in the course of the thirteenth century

where the three-field system was used. Leguminous crops like peas, beans and vetches rapidly followed by plants grown for commercial purposes like plants used for dyeing such as woad and madder, were indeed cultivated during the second half of the thirteenth century not only on fields normally yielding summer-corn (mostly oats) in a compulsory or voluntary three-course system, but even on the fallow during the year-of-rest (61). These innovations were often the initiative of small peasants and were resisted without much success by large landowners because amongst other things they feared soil-exhaustion. These cultivation methods were clearly manifestations of intensive husbandry. On the one hand they were stimulated by urban economy, especially by the needs of the textile industry in fertile regions such as South Flanders (region of Lille), the Hesbaye region and the Kölner Bucht. On the other hand cattle-raising which was clearly extended from the late twelfth century onwards played an important part in the same regions. Cattle-raising was stimulated by the towns, particularly through investments by way of so-called livestock leases (*baux à cheptel*), which became more and more common (62). Technically the extension of cattle-raising was made possible through the cultivation of fodderplants which enabled stable-feeding on a far larger scale than before. The more efficient production of manure maintained soil fertility despite the reduction of the fallow and of common services linked to the three-field-system such as common grazing.

If one were to use the expression "agricultural revolution" it would only be justified to do so with respect to the thirteenth century, and only in the highly urbanized regions of North-West Europe. The fundamental changes in agriculture subsumed under this expression were not so much the cause as the consequence of the demographic explosion of the eleventh, twelfth and thirteenth centuries. For the latter phenomenon other explanations than an agricultural revolution before the end of the twelfth century, which has been proved to be very improbable, will have to be found.

This conclusion is confirmed by our collaborator Erik Thoen in his recent doctoral thesis. This study treats the agrarian economy of the Flemish countryside in an extensive region south of Ghent during the late Middle Ages. He confirms that all kinds of new



farming techniques, which were considered a.o. by Slicher van Bath as expressions of agricultural intensification from the fourteenth and fifteenth century, in fact already existed before the fourteenth century (63). This applies to the use of labour-intensive agricultural implements such as the typical Flemish harvest implement called *pik*, which replaced the sickle, and to the cultivation of arable land during the year-of rest.

From an economic point of view this means that these innovations did not take place in a period of economic contraction such as the late Middle Ages but on the contrary in a period of economic growth. In Thoen's opinion, this phenomenon is caused by the fact that in the county of Flanders, early urbanized, the possibilities to invest in agriculture were more real than in non-urbanized regions. The tendency towards decreasing labour productivity which is typical for periods of economic growth, thus could partly be avoided. According to Thoen, because of the concentration of urban markets, even the remotest land in Flanders had a surplus value. In urbanized areas the surplus value rises faster than in city-less areas. If it were the peasants themselves who could profit from this rise in value as a consequence of different phenomena such as the tendency towards nominal stability of feudal obligations, then investments created agrarian progress. His conclusion is that the presence of towns in itself does not explain the agricultural progress in thirteenth century Flanders, if it is not seen in combination with feudal structures. At the same time, and once more, this explanation emphasizes the strong relation between urban and agrarian economy. Moreover the mentioned study reveals the complex mechanism that could cause and explain the agricultural intensification especially by way of technical innovations.

Our final conclusion is that this mechanism can not be described either as an "agricultural revolution".

## NOTES

- (1) J. Ziman, *The Force of Knowledge. The Scientific Dimension of Society*, Cambridge, 1987, p. 35.
- (2) G. Duby, *L'économie rurale et la vie des campagnes dans l'Occident médiéval*, I, Paris, 1977, p. 88. For the agronomic literature in Latin, see the review in L.I.M. Columella, *De Re rustica*, W. Richter, ed., München-Zürich, 1983 (Sammlung Tusculum), III, p. 569 f.f. (with bibliography).
- (3) Duby, *Economie rurale*, I, pp. 176-177.
- (4) D. Ochinsky, *Walter of Henley and other Treatises on Estate Management and Accounting*, Oxford, 1971; concerning the date see p. 144.
- (5) *Ibidem*. Also in the book written in Latin called *Fleta* about English law (ca. 1290) (see R. Van Caenegem, v<sup>o</sup> *Fleta*, in: *Lexikon des Mittelalters*, München-Zürich, 1987, vol. IV, kol. 546-547) similar data can be found.
- (6) W. Richter, *Die Überlieferung der "Ruralia commoda" des Petrus de Crescentiis im 14. Jahrhundert*, in: *Mittellateinisches Jahrbuch* 16 (1981), pp. 223-275; see also G. Sarton, *Introduction to the History of Science*, III, 1947, p. 811 f.f.
- (7) See Richter (ed.), *Columella*, pp. 651-652 (see above our note 2).
- (8) W. Abel (ed.) - H. Dreitzel (transl.), *Konrad Heresbach, Vier Bücher über Landwirtschaft*, Meisenheim, 1970 (contains both the original edition in Latin from 1570 and the German translation).
- (9) See also S. von Frauendorfer, *Ideengeschichte der Agrarwirtschaft und Agrarpolitik im deutschen Sprachgebiet*, München, 1957, vol. I, pp. 118-120.

- (10) Duby, *Economie rurale*, I, pp. 177-178.
- (11) M. Morineau, Révolution agricole, révolution alimentaire, révolution démographique, in: *Annales de Démographie historique*, 1974, reprinted in: id., *Pour une histoire économique vraie*, Lille, 1985, p. 259.
- (12) B.H. Slicher van Bath, *The Agrarian History of Western Europe A.D. 500-1850*, Utrecht-Antwerp, 1960, p. 262.
- (13) A.J. Bourde, *Agronomie et agronomes en France au XVIIIe siècle*, Paris, 1967, 3 vols.
- (14) See for example part I, pp. 18-29.
- (15) O. De Serres, *Le Théâtre d'Agriculture et Mesnage des Champs*, N.-L. François de Neufchateau ed., Paris, 1804, I, p. LXXXV, cited by M.-J. Tits-Dieuaide, *Les campagnes flamandes du XIIIe au XVIIIe siècle ou le succès d'une agriculture traditionnelle*, in: *Annales. E.S.C.*, 1984, p. 590.
- (16) J. Craeybeckx, *The Depression of the Late Nineteenth Century and the Recovery Before 1914*, in: A. Verhulst G. Bublot (eds.), *Agriculture in Belgium. Yesterday and Today*, Mercatorfonds/Cultura, Brussels, 1980, pp. 41-43.
- (17) A survey of the use of the expressions "agrarian" and "agricultural revolution" in: D. Grigg, *The Dynamics of Agricultural Change*, London, 1982, pp. 177-192.
- (18) W.G.Hoskins, *The Making of the English Landscape*, Harmondsworth, 1970, pp. 142-210.
- (19) K. Marx, *Das Kapital*, vol. 1, Berlin, 1961 (reprint of the edition Moscow 1932), pp. 755-789.
- (20) About these innovations see: B.H. Slicher van Bath, *The Agrarian History of Western Europe A.D. 500-1850*, pp. 262-340; Bourde, *Agronomie*, I, pp. 277-309. See also note (20) below.

- (21) Besides the above mentioned standard work of Slicher van Bath, see also his article, *The Rise of intensive Husbandry in the Low Countries*, in: *Britain and the Netherlands*, J.S. Bromley - E.H. Kossmann (eds.), London 1960, pp. 130-153 (partly reprinted in: Ch. K. Warner (ed.), *Agrarian Conditions in Modern European History*, New York, 1966, pp. 24-42). See also the standard work of P. Lindemans, *Geschiedenis van de Landbouw in België*, 2 vols. Antwerp, 1952; M.-J. Tits-Dieuaide, *L'évolution des techniques agricoles en Flandre et en Brabant du XIVe au XVIIe siècle*, in: *Annales E.S.C.*, XXXVI, 1981, pp. 362-381; Id., *Les campagnes flamandes* (see above note (14)), pp. 590-610.
- (22) Grigg, *Dynamics of Agricultural Change*, pp. 164-176.
- (23) About the "agricultural revolution" of the nineteenth and twentieth centuries in Belgium: Verhulst-Bublôt (eds.), *Agriculture in Belgium*, pp. 42-47, 87-93.
- (24) See above note (20).
- (25) R. Weston, *A Discours of Husbandrie used in Brabant and Flanders*, first edition. S. Hartlieb, London, 1650; transl. in Dutch by P. Lindemans, *Sir Richard Weston, Verhandeling over de landbouw in Vlaanderen en Brabant, 1644-1645*, Bruges, 1950. Concerning this work: Lindemans, *Geschiedenis van de Landbouw*, I, p. 14 and shortly a study and new edition by M.J. Tits-Dieuaide.
- (26) A profound, critical and surveyable study of this literature is still missing. A lot of these works are unedited, often in answer to prizes offered by Academies. Provisionally see J. David, *Ouvrages concernant l'agriculture belge parus avant 1850*, Louvain, 1975 (Centre Belge d'Histoire Rurale, publication nr. 47) and a compendious list in Lindemans, op. cit., I, pp. 14-15.
- (27) C. Vandenbroeke - W. Vanderpijpen, *The Problem of the Agricultural Revolution in Flanders and Belgium: Myth or Reality ?* in: H. Van der Wee - E. Van Cauwenberghe (eds.),

Productivity of Land and Agricultural Innovation in the Low Countries (1250-1800), Louvain, 1978 (Centre Belge d'Histoire Rurale, publication Nr. 55), pp. 163-170; A. Verhulst - C. Vandebroeke (eds.), Agricultural productivity in Flanders and Brabant 14th-18th century, Ghent, 1979 (Centre Belge d'Histoire Rurale, publication Nr. 56), esp. pp. I-X (introduction written by A. Verhulst and C. Vandebroeke) and pp. 379-405 : C. Vandebroeke, Graanopbrengsten en oogstschommelingen in Zuid-Vlaanderen (17e - begin 19e eeuw); C. Vandebroeke, Landbouw in de Zuidelijke Nederlanden 1650-1815, in : *Algemene Geschiedenis der Nederlanden*, 8, Haarlem, 1979, pp. 73-101.

- (28) In addition to the studies of Slicher van Bath cited in notes (19) en (20), see especially: G.E. Fussell, *Low Countries Influence on English Farming*, in: *English Historical Review*, 74, 1959, pp. 611-622.
- (29) Lord Ernle (R.E. Prothero), *English Farming. Past and Present*, London, 1912 (6th ed. 1961).
- (30) E. Kerridge, *The Agricultural Revolution*, London, 1967; Id., *The Agricultural Revolution Reconsidered*, in: *Agricultural History*, 43, 1970, pp. 463-475; G. Mingay, *The Agricultural Revolution in English History: a Reconsideration*, in: *Agricultural History* 37, 1963, pp. 123-133; Id., *The Agricultural Revolution : Changes in Agriculture 1650-1880*, London, 1977.
- (31) H.E. Hallem, *Rural England 1066-1348*, Glasgow, 1981, pp. 13-15, 55-62.
- (32) E. Le Roy Ladurie, *La croissance agricole*, in: G. Duby-A. Wallon (eds.), *Histoire de la France rurale*, 4 vols., II, Paris, 1975, p. 417.
- (33) To compare with A. Derville, *Le grenier des Pays-Bas médiévaux*, in: *Revue du Nord* 69, 1987, pp. 267-280.

- (34) M. Morineau, Y a-t-il une révolution agricole en France au XVIIIe siècle, in: *Revue Historique*, 239, 1968, pp. 299-326; Id., *Les faux-semblants d'un démarrage économique: agriculture et démographie en France au XVIIIe siècle*, Paris, 1971 (Cahiers des Annales 30); Id., *Révolution agricole, révolution alimentaire* (see above note 10). For the most important studies of C. Vandembroeke concerning this subject, see above note (26).
- (35) G. Duby, *La révolution agricole médiévale*, in: *Revue de géographie de Lyon* 29, 1954, pp. 361-366.
- (36) Namely in his later general works, in which he not only avoided more and more the expression "revolution", but in which he also dated back the phenomenon to the period between 1000 and 1200 and even to the thirteenth and fourteenth century: Duby, *Economie rurale*, I, pp. 176-208; Id., *Medieval agriculture 900-1500*, in: C. Cipolla (ed.), *The Fontana Economic history of Europe, I, The Middle Ages*, London, 1973, pp. 175-220. In his work *Guerriers et Paysans, VIIe-XIIe siècle*, Paris, 1973, pp. 211-225, Duby didn't even use the expression "revolution" any more and he toned down the technical progress which he dated back to between 1000 and 1200. In the same work technical progress is not so much seen as a consequence of agricultural technique stricto sensu (the so-called "pratiques agraires", like field-systems, manuring), but more as a consequence of better agricultural implements, such as the plough, of the use of the draught-horse and of the better tillage which was the consequence of these improvements.
- (37) Lynn White, *Medieval Technology and Social Change*, Oxford, 1962; Id., *The Expansion of Technology*, in: Cipolla, *Fontana Economic History of Europe, I*, pp. 143-175. In: *La révolution industrielle du Moyen Age*, Paris, 1975 (coll. Points, éd. Seuil, pp.49-78), J. Gimpel devoted a chapter to "La révolution agricole", based mainly on the writings of Duby and White, in which he explains the demographic explosion of the eleventh-thirteenth centuries by the technical progress in agriculture.
- (38) Slicher van Bath, *The Agrarian History*, pp. 197-209.

- (39) See above notes 19 and 20.
- (40) A. Verhulst, Het probleem van de verdwijning van de braak in de Vlaamse landbouw (XIIIe-XVIIIe eeuw), in: *Natuurwetenschappelijk Tijdschrift*, 38, 1956, pp. 213-219.
- (41) A. Verhulst, L'intensification et la commercialisation de l'agriculture dans les Pays-Bas Méridionaux au XIIIe siècle, in: *La Belgique rurale. Mélanges J.J. Hoëbanx*, Brussel, 1985, pp. 89-100 including references to the studies of the authors mentioned.
- (42) Recent surveys of this criticism in W. Rösener, *Bauern im Mittelalter*, München, 1985, pp. 118-133; K. Hermann, *Pflügen, Säen, Ernten. Landarbeit und Landtechnik in der Geschichte*, Hamburg, 1985, pp. 74-85; R. Fossier, *Enfance de l'Europe. Aspects économiques et sociaux*, Paris, 1982, II, pp. 615-656 (*Nouvelle Clio* nr. 17 bis); A.M. Watson, *New Crops and Farming Techniques in the Early Middle Ages*, in J.A. Raftis (ed.), *Pathways to Medieval Peasants*, Toronto, 1981, pp. 65-82.
- (43) Verhulst, *Intensification et commercialisation*, including the studies mentioned in it by Derville, Van Uytven, Mertens, Irsigler.
- (44) This classical view is based on the well-known work of R. Lefebvre des Noëttes, *L'attelage, le cheval de selle à travers les âges*, 2 vols., Paris, 1931.
- (45) Slicher van Bath, *Agrarian History*, pp. 71-72.
- (46) G. Duby, *Le problème des techniques agricoles*, in: *Agricoltura e Mondo rurale in Occidente nell'alto Medioevo*, Spoleto, 1966, pp. 167-183 (*Settimane di Studio* 13).
- (47) See the article of B.H. Slicher van Bath, *Le climat et les récoltes au haut moyen âge*. This article is published in the proceedings of the Spoleto conference mentioned in note (45), pp. 399-425. See also the discussion between Duby and Slicher in Spoleto published pp. 443-447.

- (48) One of the most recent contributions to this debate is M. Montanari, *Considerazioni sull'Italia padana dal IX al XV secolo*, in: *Quaderni Medievali* 12, 1981, pp. 63-81, reprinted in Montanari, *Campagne medievali*, Turin, 1984, pp. 55-85 and subtitled *Techniche e rapporti de produzione: le rese cerealicole dal IX al XV secolo*, in: B. Andreolli, V. Fumagalli, M. Montanari (eds.), *Le campagne italiane prima e dopo il mille*, Bologna, 1985, pp. 45-68 (with earlier literature).
- (49) A. Derville, *Dîmes, rendements du blé et "révolution agricole" dans le Nord de la France au Moyen Age*, in: *Annales, E.S.C.*, 6, Nov.-Dec. 1987, pp. 1411-1432.
- (50) Cfr. W. Harwood Long, *The Low Yield of Corn in Medieval England*, in: *Economic History Review*, 32, 1979, pp. 459-469; Tits-Dieuaide, *Evolution des techniques agricoles* (see above note (20)), pp. 363-364.
- (51) G. Raepsaet, *La faiblesse de l'attelage antique: la fin d'un mythe ?*, in: *L'Antiquité Classique*, 48, 1979, pp. 171-176; Id., *Attelages antiques dans le Nord de la Gaule*, in: *Trierer Zeitschrift*, 45, 1982, pp. 215-273.
- (52) J. Langdon, *Horse Hauling: a Revolution in Vehicle Transport in Twelfth- and Thirteenth Century England ?*, in: *Past and Present*, 103, 1984, pp. 37-66; Id., *Horses, Oxen and Technological Innovation*, Cambridge, 1986.
- (53) Results of recent historical and archeological research concerning the plough can be found in H. Beck, D. Denecke, H. Jankuhn (eds.), *Untersuchungen zur eisenzeitlichen und frühmittelalterlichen Flur in Mitteleuropa und ihrer Nützung*, II, Göttingen, 1980 (*Abhandlungen der Akademie der Wissenschaften in Göttingen, Phil.-Histor. Klasse*, III, nr. 116).
- (54) Langdon, *Horses, Oxen*, pp. 127-141 and pp. 244-246.
- (55) Surveys about recent views on this subject, in: M. Born, *Die Entwicklung der deutschen Agrarlandschaft*, Darmstadt, 1974;



Id., *Geographie der ländlichen Siedlungen, I: Die Genese der siedlungsformen in Mitteleuropa*, Stuttgart, 1977. A large Anglo-Saxon literature exists on this subject, mentioned by Watson, *New Crops and Farming Techniques* (see above note (41)), p. 80 note 9. Especially deserving of our attention is Hoffmann, *Medieval Origins of the Common Fields*, in: W.N. Parker - E.L. Jones (eds.), *European Peasants and their Markets. Essays in Agrarian Economic History*, Princeton, 1975, pp. 43 f.f.

- (56) G. Schroeder-Lembke, *Zur Flurform der Karolingerzeit*, in: *Zeitschrift für Agrargeschichte und Agrarsoziologie* 9, 1961, pp. 143-152.
- (57) A. Verhulst, *Le paysage rural en Flandre intérieure: son évolution entre le IXe et le XIIIe siècle*, in: *Revue du Nord*, 62, 1980, pp. 11-30.
- (58) A. Verhulst - D.P. Blok, *Landschap en bewoning tot ca. 1000*, in: *Algemene Geschiedenis der Nederlanden*, vol. I, Haarlem, 1981, pp. 153-164.
- (59) See the case-study by L. Van Durme, *Toponymie van Velzeke-Ruddershove en Bochoute*, I, Ghent, 1986, pp. 256-265.
- (60) Note that on the one hand there is a consensus that in S.W. Germany, the three-fieldsystem had a large diffusion since the early Middle Ages (eight-ninth centuries), but that on the other hand this system was restricted to the arable land of large domains even during the late Middle Ages. See: E. Schillinger, *Studien über die Beziehungen zwischen Herrschaftsgut und Zeltverfassung, vorwiegend nach den Urbaren des südlichen Oberrheingebiets*, in: *Zeitschrift für die Geschichte des Oberrheins* 130, 1982, pp. 81-166.
- (61) Fossier, *Enfance de l'Europe*, II, pp. 654-656.
- (62) Verhulst, *Intensification et commercialisation*. (see above note 40).

- (63) A. Verhulst, De evolutie en de betekenis van de veeteelt in de landbouweconomie van de 13e eeuw in de Zuidelijke Nederlanden, in: Album Charles Verlinden, Ghent, 1975, pp. 467-476 (reprinted separately as publication Nr. 46 of the Centre Belge d'Histoire Rurale).
- (64) E. Thoen, Landbouweconomie en bevolking in Vlaanderen gedurende de late Middeleeuwen en het begin van de Moderne Tijden. Test-case: De kasselrijen van Aalst en Oudenaarde. Eind 13de - eerste helft 16de eeuw. (Centre Belge d'Histoire Rurale, publication Nr. 90, Ghent, 1988).