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INTRODUCTION

A liberated slave named Gaius Furius Chresimus was very unpopular because he obtained much more bountiful crops from a rather modest farm than his neighbours did from their very large estates, and it was thought that he was using magic spells to entice away other people's crops. He was therefore indicted by the curule aedile Spurius Albinus; and, fearing that he would be found guilty when the time came for the tribes to return their verdict, he brought into court all his agricultural implements, and led in his farm servants, sturdy people, all well-clad and well cared-for. He brought in iron tools of excellent workmanship, heavy mattocks, ponderous ploughshares, and well-fed oxen. 'These, citizens,' he said, 'are my magic spells; I cannot show you or produce to you in court my midnight toil, my early risings and my sweat.' This caused him to be acquitted by a unanimous verdict. (Pliny, *NH* 18. 41–3)

1. SCOPE OF THE ENQUIRY

Throughout Roman history, a very large percentage of the population was engaged in some branch of agriculture. The earliest evidence we have concerning early settlement in and around Rome points to a fairly large population, most of whom were engaged in subsistence farming on small plots of ground. The predominant features of soil and climate in this region, and the size of farm units, tended to promote the growth of an intensive smallholding farm economy, such as may still be found in many parts of Italy today. The variety of crops, the limited size of farm units, and the need to maximize productivity have combined to spur on the husbandman to conserve the precious topsoil, to replenish its fertility, and to work with speed and ingenuity in face of a climate that is more than ordinarily capricious. The careful tillage required by this type of farming has resulted in the development of a range of digging and cultivating tools, each adapted to meet regional or local requirements. In many spheres of ancient economic activity, for example in mining and metallurgy, in engineering and in industry, we are hampered in our enquiries by lack of adequate technical information in the literary sources; and the investigator is obliged to rely largely on archaeological evidence.[1] In agriculture, however, the case is different; for we possess a valuable collection of literary sources from which we can obtain much detailed information on the tools employed in, and the techniques applied to, many different farming operations; in the case of viticulture in particular, there

[1] See, for example, F. M. de Robertis, 'Sulla considerazione sociale del lavoro nel mondo Romano', in *Problemi economici dall'antichità ad oggi* (Milan, 1959), pp. 54–70.

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is an abundance of information on all the complex and varied techniques employed. This should occasion no surprise: for agriculture enjoyed a position of unchallenged eminence. Thus on the basis of the surviving texts, supported and illustrated by the monumental evidence, together with that of surviving implements, it is possible to present a full account of agricultural activity in all its variety. Nor is our information seriously limited either in time or place; our major literary sources cover a span of more than five centuries, and although there are large gaps in the record, phases of progress and of decline can be assessed; and while Italy occupies a pre-eminent place, the agricultural history of some at least of the provinces can be pieced together.

In working through the Roman authorities for details of agricultural operations I have frequently run into difficulties of interpretation. Many of these difficulties are due to lack of precision in the translation of Latin terms for implements and operations in lexica, dictionaries of antiquities and the commentaries on the ancient texts. Since a knowledge of the precise function of an implement is often critical for a full understanding of the technique in question, I have compiled the following monograph, in which I have attempted to clear up a number of these problems.

The volume of material to be dealt with is considerable: M. G. Bruno[1] has provided a list of sixty verbs employed in the texts to describe various agricultural operations, and of sixty implements or parts of implements. Correlation of the literary evidence with surviving examples of implements is by no means easy, for the following reasons:

(*a*) Very few of the implements referred to by the writers are described in sufficient detail to enable one to reconstruct the essentials of shape and design (a notable exception is the clear description of the complex form and varied functions of the *falx vinitoria* given by Columella (4. 25).[2]

(*b*) The surviving implements in the museum collections have rarely been accurately classified; iron implements, which require careful protection against rust, are rarely found in a good state of preservation, and are frequently discovered, especially in some of the larger museums, lying unprotected and unidentified, save for the find-spot, in the basements. Notable exceptions are the collection of agricultural implements

[1] 'Il lessico agricolo latino e le sue continuazioni romanze', *Rend. Ist. Lomb.* XCI (1957), 381–406, and 921–1035 (on the agricultural vocabulary) (= Bruno, *Lessico*); idem, 'Apporti delle Glosse alla conoscenza del lessico agricolo latino', *Rend. Ist. Lomb.* XCIII (1959), 115–54 (on the value of the Glossaria) (= Bruno, *Apporti*).

[2] See the excellent article by E. de St-Denis, 'Falx vinitoria', *Revue Archéologique*, XLI (1953), 163–76; also the detailed discussion of pruning implements and operations by L. Savastano, *L'Arboricoltura* (Naples, 1914) (= Savastano, *Arboricoltura*). This comprehensive work covers in detail all the technical processes of silviculture, with special reference to the cultivation of vines, olives and orchard trees.

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from Boscoreale near Pompeii, now housed in the Natural History Museum at Chicago,[1] and the collections of tools and weapons assembled in the reconstructed German frontier station at Saalburg, near Frankfurt.[2]

(*c*) The representations of implements on surviving monuments are not always sufficiently precise to make identification certain; nor are the solutions of these technical problems made any easier by the inaccurate pronouncements often made by the compilers of the standard dictionaries of antiquities.[3]

Since form and function are closely related, it seems that the first task in this enquiry should be to consider in detail what is known about the functions of the various implements, grouping them into broad general classes, such as spades, mattocks, knives, forks and so on, and then, within this framework, to discuss each implement in turn, giving first the lexicographical information, then the principal literary references (technical sources first, followed by non-technical), and then the monumental evidence. It is of course obvious that a classification by functions cannot be precise; there is much overlapping, since the same tool was frequently employed for more than one operation, and the same operation was carried out with many different tools. But it is hoped that this method will help to clear up some of the difficulties, and make some contribution, however tentative, to the study of Roman agricultural techniques.

[1] See H. F. Cou, *Antiquities from Boscoreale in the Museum of Natural History, Chicago* (Chicago, 1912), pp. 210 ff., and pls. 143–6.

[2] Saalburgmuseum, Frankfurt am Main. Numerous photographs and drawings of objects from the rich Saalburg collections are to be found, with full documentation, in L. Jacobi, *Das Römerkastell Saalburg* (Homburg von der Höhe, 1897), and in the *Saalburgjahrbuch*, Frankfurt am Main, 1910–). By contrast, many of the items from the rich collection of agricultural implements in the Museo Nazionale at Naples have never been catalogued, though many of them are known through reproductions in comprehensive works such as Petrie's *Tools and Weapons* (see p. 20, n. 1).

[3] E.g. Ch. Daremberg and Edm. Saglio, *Dictionnaire des antiquités grecques et romaines* (Paris, 1877–1919) (= Daremberg–Saglio); in this work the literary references are usually exhaustive, but many of the references to monumental sources refer to obsolete or inaccessible publications; the treatment of implements is very uneven. A. Rich, *A Dictionary of Roman and Greek Antiquities* (4th ed. London, 1874) (= Rich, *Dict. Ant.*) is particularly sound on technical matters; the figures in the text are usually clear, and the comment informative; the monumental references are unfortunately vague. The treatment of implements in Pauly–Wissowa–Kroll, *Real-Encyclopädie der Classischen Altertumswissenschaft* (= *R-E*) is also uneven. Some important implements (e.g. 'marra', 'mergae', 'rutrum'), are not mentioned; in other cases (e.g. 'ascia') the technical aspects are either ignored or given very cursory treatment.

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2. EVOLUTION OF IMPLEMENTS AND SPECIALIZATION OF FUNCTION

The study of the historical evolution of tools is no mere academic exercise for supporters of the 'diffusionist' or 'separate invention' schools. It is a matter of considerable interest for the student of social and economic history. Some implements, invented at a very early stage in the history of cultivation, or even antedating the beginnings of agriculture, have retained their basic shape and function almost unchanged for many centuries until the advent of the machine; such is the case with the sickle.[1] In other cases, the replacement of a particular tool by an improved type, or the introduction of a more efficient one, may be correlated with changes in the pattern of land use in a given area, or with the results of conquest. Unfortunately, it is only in recent years that accurate listing of artefacts found on specific sites has become standard practice, so that many surviving implements cannot with certainty be ascribed to their source. As we have already noticed this is particularly evident in the case of iron tools; large numbers of such artefacts may be seen lying unclassified in the basements of museums, most of them now so badly corroded as to make identification impossible. In spite of these difficulties of identification and ascription, some attempt is made in the following pages to suggest historical connections where there seems to be sufficient evidence to justify them.

3. DIVERSITY IN THE DESIGN OF IMPLEMENTS

The list of agricultural implements discussed in the following pages comprises fifty separate items, including twelve distinct types of *falx*. There are two main reasons for this remarkable variety of types and designs of implement: (1) the adaptation, over many centuries of experience, of a single, basic implement, e.g. the digging-hoe, to the varying requirements of the different soils and climatic conditions which are to be found in the various regions of Italy; (2) the complicated régimes of cultivation demanded by individual plants, such as the vine, and by the systems of intercultivation of sown and planted crops which came to prevail in different areas. The study of the implements themselves cannot be divorced from that of the operations involved in each particular system of cultivation. In the following pages the documentation of the

[1] See A. Steensberg, *Ancient Harvesting Implements*, translated by W. E. Calvert (Copenhagen, 1943) (= Steensberg). This comprehensive work, based primarily on the Copenhagen collection, and on actual experiments with surviving implements, includes an historical classification, and a full bibliography.

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sources of information has been made as complete as possible, and each particular context is set out, so that the design and functions of each implement may be studied in its operational context.

4. CONTINUITY AND SURVIVAL OF TYPES OF IMPLEMENT

Regional differences both in designs and names of implements go far back into Roman history, and continue to survive in areas where manual cultivation is still the rule, for example in South Italy and Sicily, as well as in parts of North Africa, Spain and France. The survival of the name of a Roman implement is of course no guarantee that the implement employed by the Italians, French or Spanish farmer is identical with its Roman prototype; but from the evidence furnished by historians of husbandry it is clear that traditional types have persisted for centuries, and that implements, like yoke and harness systems, are strongly regionalized so far as their design is concerned.[1] Like Greek tragedy, they have attained the shape and pattern most convenient for their purpose, and have persisted unchanged over long periods of time. Valuable evidence on the survival of the names of implements and processes is to be found in Walde–Hofmann's *Lateinisches etymologisches Wörterbuch*, and in the recent work of M. G. Bruno already referred to above (p. 2). Such survivals are mentioned in the notes on individual implements in the following pages.

5. NOTES ON THE SOURCES

1. *Lexicographical*

The ancient lexica and glossaries seldom provide information which cannot be obtained in more precise detail from other sources. Usually they are too generalized to be of any help: for example, Hesychius, s.v. μάρρον, the Roman *marra*, merely reports that it is a tool made of iron, while the Glossaries equate the term *ligo* with an astonishing variety of implements both Greek and Latin, giving little help towards solving the problem of identification. It is essential, however, that this class of evidence should be thoroughly sifted, for it may throw valuable light on the meaning of a term or an operation. M. G. Bruno's lexicon is most valuable as a comprehensive word-list of agricultural terms, and is

[1] See G. E. Fussell, *The Farmer's Tools, 1500–1900* (Melrose, 1952) (on the history of English farm implements); C. Jaberg and J. Jud, *Sprach- und Sachatlas Italiens und der Südschweiz* (Zürich, 1928–40) (= Jaberg–Jud). This invaluable work of reference contains a full classification of farm implements within the selected area, with drawings to scale of numerous surviving types, together with maps showing the regional distribution of the various implements and their local names.

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particularly helpful in furnishing lists of surviving terms of Latin origin in the Romance languages, both obsolete and contemporary. But it does not pretend to be more than a word-list. The etymological dictionaries of Meyer-Lübke, Walde–Hofmann and Ernout–Meillet may often be consulted with profit, but ill-founded conjectures are all too frequent where silence would be appropriate, while at the same time there are rare items where no help whatsoever is to be found in any of them; thus the word *scudicia*, which appears in Isidore's list of *instrumenta rustica* (*Etym.* 20. 14), and is there described by him as a trenching tool equivalent to *fossorium*, is not mentioned by Meyer-Lübke. The word appears in Walde–Hofmann as neuter plural instead of feminine singular, is defined as a spade (*Grabscheit*) or a hoe (*Hacke*), and given a most unlikely derivation from *excudere*, to beat out, which is not at all the action required from the implement as described by Isidore.

2. *Ancient lists of agricultural equipment*

Five such lists have survived from Roman times. Varro's list of *instrumenta rustica* (*LL* 5. 134 ff.), which includes milling equipment, baskets and other containers as well as field implements, mentions only ten items out of more than sixty discussed in the present work. The notes are very brief, rarely lucid, and are usually accompanied by ridiculous etymological explanations. Isidore's list (*Etym.* 20. 14) contains twice as many items as that of Varro; the definitions are in many cases precise, and may well be derived from reliable earlier sources. He includes some terms (e.g. *falcastrum*, a later term synonymous with *runco*), several of which, though not found elsewhere, survive in the Romance languages. Two of the agricultural writers, the earliest and the latest of the surviving Roman authorities, include lists of implements and equipment. Cato (*De Agri Cultura* 10 and 11) provides complete inventories of equipment required for stocking an oliveyard of 240 *iugera* and a vineyard of 100 *iugera* respectively; but these are merely lists of items for the farmer's stock-books, and contain no explanatory information. Palladius concludes the first book of his *De Re Rustica* (1. 43) with a comprehensive list of farm requirements, including a few items of clothing and surgical equipment as well as a list of tools. Thirteen manual implements are included, and some of the less common items (e.g. the *lupus*, a special type of pruning saw designed for working in a confined space), are fully defined. In the other writers, uncommon or complicated tools are often described in some detail; the classic example is the careful description of the six parts of the *falx vinitoria* (the vine-dresser's knife) given by Columella (*RR* 4. 25).

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3. *The Roman writers*

Apart from the lists cited in the previous section, the Roman agricultural writers provide a considerable amount of information on the various operations carried out with the aid of the implements that they mention. Some of these, e.g. harvesting, hoeing and weeding, are very fully documented, while for others information is often scanty. It should be remembered that our surviving authorities are handbooks for farmers, not scholarly treatises. Other non-technical sources often furnish valuable information (e.g. on *marra* and *falx*), so that by piecing together a number of scattered references it is often possible to obtain a fairly clear picture of both the form and the functions of a particular implement. Nevertheless, great care must be exercised in using this class of evidence. For example, it would be dangerous to conclude, on the basis of Ovid's *longi ligones* (*Pont.* 1. 8. 59), and in the absence of collateral evidence, that the *ligo* was a long-handled implement.

Vergil's *Georgics* contain very little information on manual implements. The list of *arma* (*G.* 1. 160) consists almost entirely of animal-drawn implements; and the endless editorial discussions of the meaning of *currus*, *traheae* and *iniquo pondere rastri* might have been more profitably devoted to some of the difficult problems presented by our major sources. In particular, the lack of modern commentaries on Columella and Palladius is a major handicap to those engaged in the study of the technical aspects of Roman agriculture.

4. *References to implements in non-technical sources*

Since agriculture occupied so large a place in Roman life at all periods, it is not surprising to find that, apart from the technical treatises, references to tools and operations abound in literature, in both prose and poetry. As one might well expect, many of the references in this category are quite unspecific: thus *rastrum*, specifically the multi-tined heavy clod-breaking implement, occurs very frequently in non-technical sources, and commonly symbolizes, in a general way, the hard manual labour of the field or orchard. Frequently, however, the references in non-technical writers help to complete our knowledge of the form or functions of a particular implement. A good example of the value of this class of evidence is to be found in the references to the *ligo*, one of a large category of mattock-type implements, which was so common that none of the agronomists gives details of its design. Two passages, one from Statius and the other from Ovid, provide useful information concerning its design and the method of using it, while a third, from Martial, gives information on

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the regional distribution of the implement.[1] In general, however, great care should be exercised in dealing with casual references to familiar implements in non-technical writers. Editors and translators frequently make serious errors of interpretation, especially of terms (e.g. *falx*) which cover a range of different meanings. The appropriate meaning can usually be inferred from the context, provided that the editor of the text in question has some knowledge of the particular operation. In view of the special difficulties concerning *falx*, a comprehensive collection of literary references, based almost entirely on the references provided in the *Thesaurus*, s.v. 'falx', has been compiled, with cross-references under each heading to the discussion in the text (Appendix E, p. 205).

The ancient commentaries on the agricultural writers, notably that of Servius on Vergil's *Georgics*, are another important source. Although his interpretations are frequently wrong, Servius, who wrote in the fourth century A.D., occasionally reflects aspects of the changing pattern of agricultural practice, and gives information which is useful, if carefully sifted and placed in its historical context. A good example of the strength and weakness of Servius is his interpretation of the word *currus* as part of a wheeled plough at *Georgics* 1. 174, where his account seems clearly anachronistic, and presumably reflects the conditions of his own day.

5. *Tools found on Roman sites*

Iron tools are the bane of archaeologists and museum authorities, owing to the notorious effects of corrosion upon the shape and size. In addition, many of the collections in the larger and older museums have never been classified, since excavators in earlier times did not think it worth while to annotate such humble items at the time of their discovery, so that they are often of little or no use to the investigator. Amongst the notable exceptions already mentioned (above, p. 3) is the small but fine collection of agricultural implements found at the *villa* of Herennius Florus at Boscoreale on the slopes of Mount Vesuvius, and now in Chicago; but not all of these implements have been correctly identified (see Appendix B, p. 198). A new standard of classification and documentation in this department was set by those concerned with the arrangement of the Saalburg collections (above, p. 3), and their example has been followed with regard to more recent finds in other Roman centres, e.g. at the Roman frontier post of Newstead, near Melrose, Scotland (see J. Curle, *A Roman Frontier Post and its People*, Glasgow, 1911). A vast amount of research has been done on the problems associated with the designs of

[1] Ovid, *Amores* 3. 10. 31; Statius, *Thebaid* 3. 587; Martial, *Epigrams* 4. 64. 32.

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Roman ploughs.[1] But no attempt has been made to study systematically the numerous surviving iron ploughshares of varying shape, size and weight, in order to amplify and clarify the often intractable literary and monumental evidence. Other agricultural implements have been very inadequately studied. Apart from the work of E. Werth,[2] there is nothing on spades or mattocks to match the magnificent monograph of A. Steensberg on ancient harvesting implements from Scandinavia, or that of G. E. Fussell on the manual implements of the English farmer (p. 4, n. 1; p. 5, n. 1).

The local and regional distribution of implements, apart from ploughs, is among the many neglected aspects of the subject. The topic is briefly referred to by Lynn White,[3] who suggests that iron implements seem to have been more prevalent in the northern provinces than to the south. Of equal importance is the question of the efficiency of the implements used by Roman farmers. Much light, for example, might be thrown on problems concerning trenching and hoeing if Steensberg's example were to be followed, and implements of Roman type constructed and used experimentally, as is now being attempted with Stone Age implements and Iron Age ploughs by investigators in Britain. To divorce the study of the implement from that of its operation is disastrous. The latest work in English on Greek and Roman farm implements, that of E. M. Jope,[4] is not only far from complete as a factual survey, but contains almost no information as to how the implements described were used. E. de St-Denis's article on the *falx vinitoria*, and some recent studies of Palladius' reaping machine,[5] remain isolated examples of what ought to be done.

[1] See P. Leser, *Die Entstehung und Verbreitung des Pfluges* (Münster-i.-Westph. 1931) (contains classification of ploughs by families, and many illustrations of ploughs from all parts of the world); A. G. Haudricourt and M. J.-B. Delamarre, *L'Homme et la charrue à travers le monde* (3rd ed. Paris, 1955) (with full bibliography). This latter work, as its title implies, attempts to relate differences in design to regional and local conditions.

[2] E. Werth, *Grabstock, Hacke und Pflug* (Ludwigsburg, 1954).

[3] Lynn White, jr., *Mediaeval Technology and Social Change* (Oxford, 1962). The vast collection of agricultural implements from the neighbourhood of Pompeii, now in the Naples Museum, hardly bears out the author's impression of first century A.D. Pompeii as 'still living more in a Bronze than an Iron Age' (*op. cit.* p. 40).

[4] *Art.* 'Agricultural implements' in *A History of Technology*, ed. C. Singer and others (Oxford, 1956), II, 81–102 (= Jope, *HT*).

[5] De St-Denis, *art. cit.* (p. 2, n. 2, above); M. Renard, 'Technique et agriculture en pays trévire et rémois', *Latomus*, XVIII (1959), 77–109, 307–33 (with full bibliography to date, and numerous illustrations of reconstructions of the reaping machine (the *vallus*) (= Renard)); add now J. Kolendo, 'La moissonneuse antique en Gaule romaine', *Annales* (*ESC*), XV (1960), 1099–1114 (with observations on many of the technical questions concerning the design and operation of the *vallus*) (= Kolendo).

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6. *Representations of implements on monuments*

Valuable evidence is available in the various museum collections, including representations on gems, reliefs and so forth. The vivid pictures of farming operations in Imperial Roman mosaics, especially on those from North African sites, are particularly important. Most of these latter are available for study under excellent conditions in the Musée du Bardo at Tunis. Scenes showing actual operations in progress such as those on the Zliten mosaic, where threshing with horses and oxen is depicted with consummate skill, are far more valuable than the cult figures of gods or heroes carrying implements which provide the bulk of the illustrations supplied by the standard dictionaries of antiquities. The Zliten mosaic has been accurately described and discussed by S. Aurigemma,[1] and more briefly by M. Rostovtzeff,[2] while the agricultural life of Roman Tripolitania has been fully documented with reference to the surviving monuments by P. Romanelli.[3] The monumental evidence from Gaul and Germany is covered by the comprehensive inventories of E. Espérandieu.[4] The indexes to these two latter works provide easy reference to tools and operations, but the standard of reproduction leaves much to be desired. Fortunately good replicas of many of the items listed are available for study in the museum of national antiquities of France at St Germain-en-Laye, within easy reach of Paris. Other valuable collections of sources are those of P. Gauckler and others[5] on the mosaics of Gaul and Africa. Finally, there is the first volume of a new series on Italian Africa, edited by S. Aurigemma.[6] This volume sets a very high standard of reproduction, which is so necessary for detailed study of the evidence, and also makes the evidence available without recourse to works which have been long since out of print. A recent publication of the University of Tunis[7] provides a brief account of the information on the rural life of Roman North Africa which may be

[1] 'I mosaici di Zliten', *Africa Italiana*, II (1929), 85 ff.

[2] *Social and Economic History of the Roman Empire* (2nd ed. Oxford, 1958), I, 313, pl. 59 (= Rostovtzeff, *SEHRE*²).

[3] P. Romanelli, 'La vita agricola tripolitana attraverso le rappresentazioni figurate', *Africa Italiana*, III (1930), 53–75.

[4] E. Espérandieu, *Recueil général des bas-reliefs, statues et bustes de la Gaule romaine* (Paris, 1907–29) (= Espérandieu, *Gaule*); idem, *Recueil général des bas-reliefs, statues et bustes de la Germanie romaine* (Paris, 1930).

[5] P. Gauckler, *Inventaire des mosaïques de la Gaule et d'Afrique* (Paris, Acad. des Inscr. et des Belles Lettres, 1909–15).

[6] S. Aurigemma, *L'Italia in Africa*. Le scoperte archeologiche, Tripolitania I, I monumenti di arte decorativa, i, I mosaici (Rome, 1960).

[7] Th. Prêcheur-Canonge, *La vie rurale en Afrique d'après les mosaïques*, Paris (Publ. de l'Univ. de Tunis), n.d. (1961).

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