

AGRICULTURAL TREATISES IN EURASIA BEFORE CA. 1500: THE ICEBERG METHOD, A SURVEY, AND A GRAND HYPOTHESIS

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FOR MORE THAN two thousand years, agricultural treatises have been an unbroken literary genre throughout Eurasia (including North Africa). These texts are crucial for our understanding of farming practices, but also for our understanding of intellectual history: the history of pragmatic knowledge, in particular the story of how humans collected and shared intelligence for manipulating the material world.¹ The survey presented in this article enables a new view of premodern global history by recovering the spread of information about agricultural praxis, revealing patterns of regional difference but also hitherto hidden connectivities within Eurasia and the deep roots of modern processes.² To take but one example, a global approach to the study of agricultural treatises reveals the situated forms of practical knowledge underlying the reasons for the choice of specific draught animals—a crucial question for most farmers. In England, Walter of Henley's Anglo-Norman French treatise on husbandry (ca. 1285) compared horses to oxen and claimed horses to be faster but more costly to feed and house; moreover, when the horse became old, only its skin could be used (eating horsemeat was prohibited), but an ox could be fattened to slaughter.³ In China, the choice was between water buffalo and oxen. According to the treatise of Sung Ying-hsing, published in 1637, the buffalo is twice as strong as the ox, but it needs twice as much care because it has to be housed during the winter and provided with a pond for bathing in the summer.⁴ By reading these texts comparatively, we uncover evidence about practical decision-making in both locales but also discern the similar intellectual arguments that undergirded these decisions.

While agricultural historians refer to these treatises,⁵ a comparative and comprehensive analysis of them has never before been attempted. This article aims to fill this empirical gap by surveying all the major Eurasian agricultural treatises

1 Sigaut, *Comment*, 20, 24.

2 Symes, "Introducing the Medieval Globe."

3 Oschinsky, *Walter of Henley*, 319.

4 Sung, *Chinese Technology*, 8.

5 For example, Zadoks, *Crop Protection*.

produced in the premodern era. The results will be useful for historians of any world region interested in agrarian topics or the codification and circulation of practical knowledge. It also offers a rich data set useful for comparative histories of regions within and beyond the Eurasian landmass because it surveys the total number of major treatises, their contents, their length, their surviving manuscripts, and their degree of influence (see Appendix 1).

This survey is also closely tied to scholarly discussions about literacy, since it concerns the conversion of orally transmitted knowledge into written texts. And yet practical handbooks of this kind have not usually been included in such research.⁶ Jack Goody has mentioned agricultural writing but assumed that it spread new knowledge,⁷ a conclusion that I have found to be mainly incorrect and also problematic, because it overlooks the ways in which agricultural knowledge was transformed into literary texts. Research on “pragmatic literacy” is a related area of research, but again, not much attention has been paid to agricultural treatises. Definitions of pragmatic literacy can be inclusive⁸ or restricted to administrative literature and record-keeping.⁹ Agricultural treatises could be seen as a part of this genre, if broadly defined, and research on pragmatic literature has certainly shown that such prosaic texts can be analyzed as documents of intellectual history.

The process of transforming oral or embodied forms of knowledge into writing is genre-specific, best captured by the German term *Literaturfähigkeit*, “something worthy of committing to writing.”¹⁰ (The English equivalent, “literacy-suitability,” is rather inelegant.) This genre specificity means that discoveries about the oral composition of epic poetry, which have been so groundbreaking for understanding the relationship between orality and literacy, cannot be taken as model for all other genres.¹¹ For instance, the documentation of theatrical plays, which overlaps with both practical manuals and literary texts, is specific to the circumstances in which a given play is committed to parchment and the reasons for the creation of a written record.¹²

So what about treatises devoted to farming? In agriculture, skills are transmitted bodily and often tacitly learned by mimicking and testing. Today, we still learn much orally and through imitation, but originally all complex activities

6 Cf. Mostert, *Medieval Communication*.

7 Goody, *The Logic of Writing*, 84–85.

8 Mostert, *Medieval Communication*, 13; Meier, “Fourteen Years,” 25.

9 Britnell, “Pragmatic Literacy,” 3–4.

10 See Pollock, *Language of the Gods*, 439–40.

11 Cf. Ong, *Orality and Literacy*.

12 Symes, “Appearance of Early Vernacular Plays.”

were taught in this way. By contrast, a written text structures knowledge in a linear fashion; a book about farming might have chapters on crops, irrigation, cultivation, and so on, which present information differently from how such knowledge is actually taught in the field. The transformation of practical intelligence into a textual form involves a fundamental restructuring of how to think about agriculture.

Would this imply that agricultural treatises contributed to a more structured way of thinking about farming? These treatises had few readers and, in many regions without surviving treatises, agriculture developed in the same direction as in those that did produce treatises. I suggest, instead, an inverted hypothesis. If a systemic approach *did* become more prevalent in agriculture, it facilitated the conceptualization of praxis as *Literaturfähig*. Thus, agricultural treatises came into being as a result of prior and concurrent developments. This could also explain why the practice of writing treatises emerged independently and simultaneously in eastern and western Eurasia. To prove such a grand hypothesis, we would need to explore all the major changes in agriculture across Eurasia, which is not the aim of this article. I will, however, tentatively return to this grand hypothesis in my conclusion.

Interpretations of Agricultural Treatises: Bias and Relativism

A peril which haunts global history is the temptation to see it as a contest among different nations and cultures. But every culture creates its own “miracle” in interaction with others.¹³ Furthermore, advances in agriculture began without books and treatises. To use the existence of agricultural treatises as the sign of a higher level of ingenuity is therefore a dangerous simplification. For example, China has a strong tradition of producing agricultural treatises and, in 2012, Chinese agronomists asserted that African agriculture has much to learn from China and devoted the first chapter of *Agricultural Development in China and Africa: A Comparative Analysis* to ancient Chinese agricultural treatises in order to argue for the superiority of the Chinese tradition.¹⁴ Another example of treatises being used to pursue an ideological agenda has surfaced in the discussion around the emergence of Islam and rates of technological change: Andrew Watson argued that a technological leap occurred in the Islamic world before and around 1000, a theory which was later criticized by Michael Decker.¹⁵ Both used agricultural treatises as their main sources. Academic debates are necessary, but this one

13 Thapar, *The Penguin History*, 18.

14 Li et al., *Agricultural Development*, 58–61.

15 Watson, *Agricultural Innovation*; Decker, *Tilling the Hateful Earth*.

opened a space for diatribes against Muslims as being incapable of contributing to historical progress. For instance, the Wikipedia article on “Arab Agricultural Revolution” received more than a hundred posts a short time after Decker opened the discussion.¹⁶

With this in mind, let us consider another charged discussion, this one about the emergence of a knowledge-based society in modern Europe. The economic historian Jan Luiten van Zanden has argued that the production of literature can be used as an indicator for the growth of human capital or, more precisely, for the development of the knowledge that promotes economic productivity.¹⁷ Together with collaborators, he constructed a very useful database of the total number of all kinds of manuscripts copied in Europe until around 1500. Thereafter, when print had largely replaced handwriting, they estimated the total number of printed books in production. This enabled a comparison with data from western Asia, India, China, and Japan, which indicated that Europe in the later Middle Ages had a faster increase in textual production than other regions in Eurasia. Van Zanden also demonstrated a correlation between increased book production in the eighteenth century and other economic variables.¹⁸ However, correlations do not immediately imply causation: in this case, it is problematic to credit written texts as agents of economic expansion in a preindustrial society when they were actually read by so very few. Joel Mokyr, who also used agricultural literature to study the emergence of a knowledge-based society, has shown that knowledge conveyed in books and pamphlets did not have much impact on technological praxis until after the mid-nineteenth century. Ordinary farmers simply did not read these books, and only a “small sliver of the agricultural sector” was directly affected, though knowledge could have spread through other channels.¹⁹

In a study of agricultural literature produced in the eighteenth century, I counted the number of books printed in English-speaking regions (England, Scotland, Ireland, North America) and all texts (in books and journals) from Scandinavia. I found that a rapid increase in the production of such texts is evident after the middle of the eighteenth century, and yet they had a restricted influence on agricultural practice because so few copies were in circulation. This was a period when cultivated areas were expanding and technology was advancing; so what was the relationship between agricultural change and the expanding literature?

16 Wikipedia. “Arab Agricultural Revolution,” https://en.wikipedia.org/wiki/Arab_Agricultural_Revolution.

17 van Zanden, *The Long Road*.

18 Baten and van Zanden, “Book Production.”

19 Mokyr, *The Enlightened Economy*, 183–89.

By tracing the topics being discussed at certain periods of time, such as the use of harrows or crop rotation, I could show a concurrence between the literature and what was happening on the ground: new knowledge was being tested and replicated in praxis and also communicated in texts. Hence, the changing content of the literature was caused by changing agricultural practice: the reverse of what had been assumed.²⁰ To be sure, literature had some practical effects in the long run because intellectuals had a keen interest in describing and endorsing the innovations that were transforming the countryside—but again, the interaction between text and practice was complex, and literature was only one, and not the most important, of the factors contributing to change. Nor was the transformation of agriculture merely a European phenomenon: most of Eurasia went through a period of rapid agrarian change in the nineteenth century. If literature is recognized as a *response* to the quickening expansion of agricultural production and technological change, this also implies that the expanded production of agricultural treatises can be analyzed in a less Eurocentric way. Moreover, as I will show in this article, the growth in the publication of these treatises had a very long and pan-Eurasian prehistory.

The “Iceberg Method”: An Approach to the Problem of Analyzing Comparative Evidence in Global History

Normally, global surveys are based on secondary sources, and although I have read quite a few of the treatises I analyze here, I cannot claim to have worked with them as primary sources in all of their original languages. My searches have accordingly been made with the help of libraries with open stacks, literature mentioned in the scholarly overviews, and, of course, internet resources to find and evaluate secondary sources (including translations).²¹ Now, if several scholars with expert knowledge of specific regions and bodies of literature worked together on a joint project, we would get a deeper knowledge of them, but not necessarily a clearer synthesis.²²

Comparability is of paramount importance in global history. Kenneth Pomeranz has argued that any regions compared should be of equal size, meaning

20 Myrdal, “Agricultural Literature,” which is a companion to the present article; together, they form a history of agricultural literature before the modern period.

21 On secondary literature as a source, see Myrdal, “On Source Criticism.” Theda Skocpol offers a short but insightful discussion on this as a methodological problem: “Emerging Agendas,” 382–83.

22 Lieberman, *Strange Parallels*, xx, on the advantages of a one-person project.

that England, for instance, cannot be compared with all of China.²³ The same is true for specific subjects; entities should be comparable. Two pitfalls in particular must be avoided. One is the “cherry-picking” of evidence to support an argument, by which anything can be “proven.” This method is depressingly common in global historiography. The second, if more respectable, pitfall is to assemble as much evidence as possible. The risk is that the quantity overwhelms the significance, and this often leads to overestimations of Europe’s importance. To avoid these pitfalls, I have suggested a new critical approach which focuses on the most salient and visible manifestations of a phenomenon.²⁴ The approach, here labelled “the Iceberg Method,” posits that the most prominent extant instances of a historical trend indicate the existence of lost or submerged sources, agents, or events. This method is not intended to replace detailed research based on primary sources; quite the contrary, since it can help to identify areas where more primary research is needed. In the case of agricultural treatises, the most salient texts reflect and communicate substantial knowledge of agricultural practice, and they also have a certain demonstrable long-term impact.

In this study, I have also used the length of a treatise as a measurement for estimating its significance, but with the recognition that word-counting is a coarse measurement, especially when comparing different languages and traditions. For example, Columella’s books on agriculture, produced in the first century CE, comprise 120,000 words in Latin and swell to about 210,000 words in English translation. In classical Chinese, the surviving parts of the oldest known treatise, written by Fan Sheng-Chih (Fanshengzhi) in the first century BCE, consist of about 3,700 Chinese characters, or 5,700 words in English. At the same time, I have excluded from the Appendix and Table 1 treatises of fewer than two to three thousand words. However, I do include shorter extant works in this analysis: for instance, a seemingly important book on ploughs written in China around 880 CE, which comprises only about 700 characters.²⁵ Works preserved only in later translations have been dated to the era in which they were originally composed, but they are not included in the table. In addition, all word counts are based on translations into modern English or other major European languages, for comparability, with the exception of one Persian treatise and most of the classical Chinese treatises. With respect to the latter, note that the number of words in English translation is normally 50–60 percent higher than the number of Chinese characters.

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23 Pomeranz, *The Great Divergence*, 7.

24 Myrdal, “On Source Criticism,” 65–70.

25 Deng, *Development versus Stagnation*, 75–76.

Table 1. Longer Extant Agricultural Texts Composed before ca. 1500 (1515) CE. This table does not include translations or manuscript copies that were subsequently made and circulated in any of these traditions, e.g., the ancient treatises copied in medieval Europe, Byzantium, or China (see Map 1). For details see the Appendix. Shaded areas denote the absence of any known writings in these regional languages.

	Greco-Roman and Byzantine	Arabic and Persian	Sanskrit	Chinese and Korean	Medieval Latin and European Vernaculars	Total
before 200 BCE	2			1		3
ca. 200–100 BCE	1					1
ca. 100–1 BCE	2			1		3
ca. 1–100 CE	2					2
ca. 100–200				1		1
ca. 200–300						0
ca. 300–400	1					1
ca. 400–500	1					1
ca. 500–600	2			1		3
ca. 600–700	1			1		2
ca. 700–800				2		2
ca. 800–900			1			1
ca. 900–1000	1	2				3
ca. 1000–1100		3	1	3		7
ca. 1100–1200		2		4		6
ca. 1200–1300		1		3	3	7
ca. 1300–1400		7		4	2	13
ca. 1400–1500		2		4	3	9
Total	13	17	2	25	8	65

I have not, moreover, counted all early translations, because it would be almost impossible to get an accurate reckoning of them, especially since many have eluded the available surveys. To take an example from my own research, Columella's work was translated into Swedish in the early sixteenth century, a fact well known in Sweden but never mentioned in any European overview. That said, I would welcome a thorough survey of these translations because they are extremely important for understanding how knowledge was transmitted.

This analysis, while comprehensive of all known agricultural treatises, excludes equine literature and Indian books on elephants, as well as botanical and medical works—though of course these specific genres often contain information about draught animals and plants. Encyclopedic works have been included if they contain substantial sections on agriculture.

As for the number of extant manuscripts and manuscript variants, this data has not been assembled in a systematic manner for all parts of Eurasia. The survival of a text and the extent of its diffusion are two different but related things. Extant copies are often of a much later date than the original composition. Moreover, the number of extant manuscripts also depends on different practices of publication, dissemination, and preservation in libraries and archives. Climate, as in southern India, or the efficiency of a given bureaucracy, as in imperial China (where outdated accounts were purged, or otherwise the pile of documents would have been overwhelming), are also factors which could dramatically diminish the survival rate of texts. The very different medieval European practice of archiving even obsolete matter also impacts the survival rate of pragmatic texts.²⁶

Finally, the relationship between the treatises and agricultural praxis is of prime importance, and often discussed in different editions. A closer examination using a wide range of sources is of prime importance.²⁷ Here, my comparative analysis of the treatises' contents is intended to gauge the extent to which they mirror actual regional conditions, partly following methods employed by Karl Butzer and Gang Deng.²⁸

26 Britnell, "Pragmatic Literacy," 24.

27 Together with Alexandra Sapoznik, I am working on a comparison of medieval treatises from thirteenth-century England and the contemporary manorial accounts. See Myrdal and Sapoznik, "Technology, Labour."

28 Butzer, "Islamic Traditions," 18–19; Deng, *Development versus Stagnation*, 62–73, 78, 82, 87, 93. I prefer proportion to the more precise percentage, as calculations of content include a number of estimations.

For Comparison: Measuring the Early Modern Expansion of Agricultural Literature

To better understand the scale at which premodern agricultural treatises were produced, it is helpful to begin with what we know about the production of agricultural treatises in the early modern era, with the advent of print. After ca. 1500, books about agriculture were printed continuously in western Europe's major vernaculars from the first half of the sixteenth century onward.²⁹ These treatises also circulated in neighbouring regions, because it took some time before they began to be composed and published in the periphery. For example, both Spanish and French treatises circulated in Portugal from the sixteenth to the eighteenth centuries.³⁰ In Scandinavia, agricultural treatises were not printed until the end of the seventeenth century.³¹

A database of printed books in English, the English Short Title Catalogue (ESTC), shows that, on average, one text/book about agriculture was published annually in England from the early sixteenth to the early eighteenth century, with evidence of a gradual increase: see Figure 1. The curve is exaggerated at the outset,

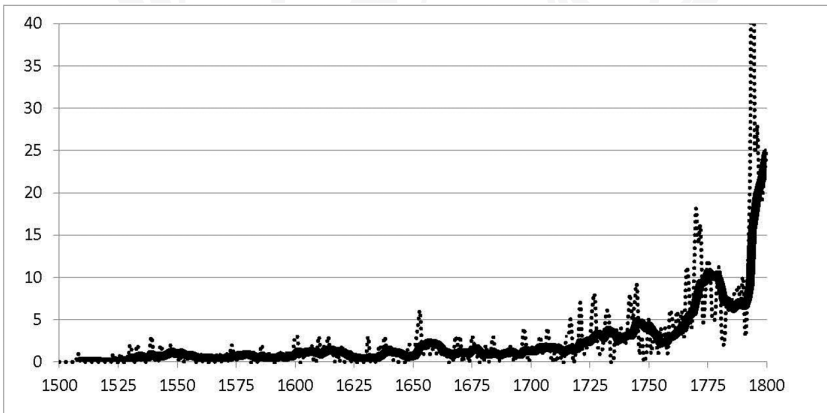


Figure 1. Diagram of Publications on Agriculture Printed in England, 1500–1800. The dotted line represents the number of published titles per annum and the boldface line represents a ten-year running average.

Source: English Short Title Catalogue (ESTC).

Note that for the period after 1641, only books have been counted.

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29 Fussell, *Classical Tradition*; Beutler, “Un Chapitre de la sensibilité.”

30 Rodrigues, “Gardening Knowledge.”

31 Myrdal, “Agricultural Treatises.”

however, because the ESTC includes every kind of printed matter for the period pre-1641, but includes only books for the following period.³² The diagram is based on the categorizations supplied by compilers of the database, so it can easily be checked, but I counted every title in the catalogue and found only slightly higher numbers that follow this curve fairly well. I discuss this eighteenth-century data in more detail elsewhere.³³

A similar trend is also evident in other countries, especially in China (less so in the Islamic countries, see below). In China, the production of new titles also increased during the early modern period. According to data compiled by Deng, the average number produced annually was 0.5 during the Ming dynasty (1368–1644), rising to 0.7 in the Qing dynasty (1644–1911),³⁴ amounting to an increase of five to seven books per decade. Thus, China seems to have produced agricultural literature at the same rate as England. According to the guidelines for regional comparison laid out by Pomeranz noted above, Europe as a whole appears to have a higher rate of production than China. This can be partly explained by the greater variety of languages in which European treatises were written and the more decentralized pattern of their publication: hence, Europe from the sixteenth century onward increasingly took a dominant position in the production of agricultural treatises.

The Long History of Agricultural Writing: A Summary of the Major Traditions

The earliest known written work devoted to agricultural practice is Sumerian, composed around 1800 BCE. It comprises fewer than a thousand words in an English translation, and is much shorter than most of the works mentioned below.³⁵ Judging from the number of tablets and fragments preserved, it must have been quite widespread in Mesopotamia for about a hundred years, until around 1700 BCE, when it sank into oblivion; there is no link to later agricultural treatises. Sometimes called an almanac, the text itself is labelled an “instruction” and speaks

32 McKitterick, “Bibliography, Population,” 84. For an estimation of annual book production in England 1475–1700, see Barnard and Bell, “Statistical Tables,” 779–85, which shows a gradual increase during the sixteenth and early seventeenth century. The entries in the ESTC do not state the number of pages for each text.

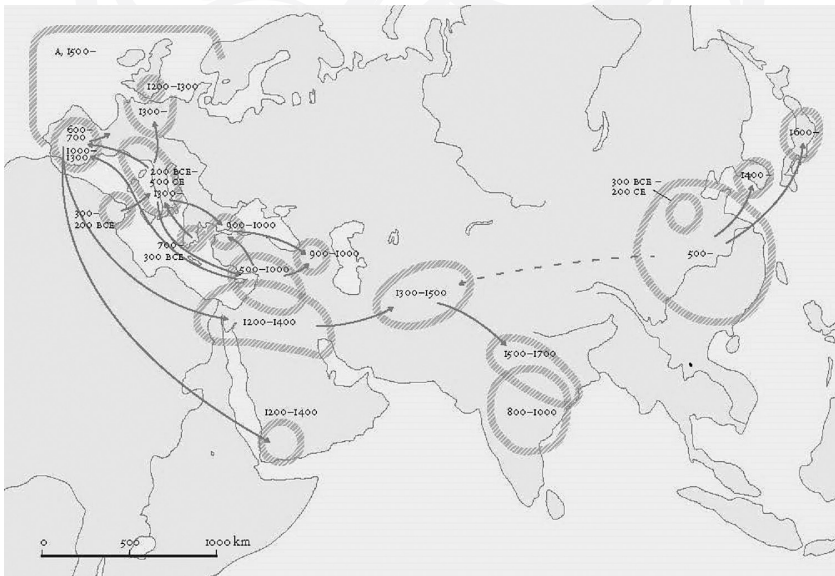
33 Myrdal, “Agricultural Literature.”

34 Deng, *Development versus Stagnation*, 28.

35 Civil, *The Farmer’s Instruction*, 28–33, with an edition of a version from about 1730 BCE (some 983 words in the English translation) and a list of all variants together with other related texts.

only to the cultivation of cereal crops. It does not, therefore, include a number of the elements associated with later almanacs.

The great and unbroken traditions of Eurasian agricultural treatises began about two and a half thousand years ago. Table 1 shows the number of extant (longer) treatises and Map 1 allows us to see patterns of diffusion and influence among regions. As I explained above, while I have not made a comprehensive survey of all translations, my analysis of the relevant scholarship has enabled this rough depiction of how treatises were disseminated. In the table, I have sorted the extant treatises into their broad cultural spheres, characterized by linguistic, political, religious, and economic affiliations. In the Islamicate world, for example, the map enables us to see that the locus of book production shifted from western Asia and North Africa to al-Andalus (Muslim Spain) and then back to western Asia, to be continued in Persia and reflecting larger historical trends.³⁶



Map 1. Regions Where Agricultural Treatises Were Composed or Compiled, and the Apparent Influences among Regions. *Arrows show influence via circulation and translation; circles mark the regions where treatises were produced. One major conclusion to be drawn from this picture is that, although the locus of agricultural treatise production shifts within western and central Eurasia, this region as a whole is comparable to imperial China as a sphere in which there was a continuous exchange of written knowledge. The bracket around Europe after 1500 marks the expansion of publication there after the advent of print.*

³⁶ See Appendix for details of the region in which each treatise was composed.

This data reveals that one to three treatises per century have been preserved from the classical period, covering more than half a millennium. Then, after a phase of stagnation, a new increase is evident, with seven to thirteen treatises preserved per century from 1000 to 1500. The Mediterranean dominates production in the earliest centuries, but it must be borne in mind that quite a few treatises compiled in China during this same era are known to have been lost. Nothing points to any significant exchange of knowledge, at least via texts, between these two main regions at this early date. This means that the genre of the agricultural treatise was invented independently in different regions. In China, the genre was confined within the empire, but with later offshoots in Korea and later still in Japan. In western and central Eurasia, the geographical trajectory of treatises changed, but there was still one continuous flow of influences. India was a third birthplace for this genre, but probably not until the ninth century CE. From around the tenth century, China and the Islamic world are dominant producers. Only in the thirteenth century does Christian Europe gradually come into focus, laying the foundations for further expansion in the early modern period.

I have been able to estimate the length of nearly half of these texts, based on word (or character) counts. Of this substantial subset, a quarter are quite brief, between two and ten thousand words (bearing in mind that even shorter texts have not been included in the table). One quarter contain between ten and fifty thousand words, another between fifty and hundred thousand. The remaining quarter are very long treatises, more than a hundred thousand words each, produced in all of the major cultural spheres.

The Greco-Roman and Byzantine Tradition

Scholarly examination of Greco-Roman treatises has been extensive³⁷ and nearly all have been translated into English. All are preserved in medieval manuscript copies, made in both the eastern Roman Empire (Byzantium) and Latin Christendom (see below). Two extant works on agriculture survive from classical Greece. One is Hesiod's *Erga kai Hēmerai* (Works and Days) from the late eighth century BCE, with about 5,000 words (in verse) devoted to agriculture. The other is the *Œconomicus* (Household Management) by Xenophon, which dates from the first half of the fourth century BCE and comprises 18,000 words, of which two thirds pertain to agriculture (ca. 12,000 words). A long, but now lost, work is known to have been authored by Mago of Carthage (North Africa) in the third century BCE, translated

³⁷ White, *Roman Farming*; Butzer, "Classical Tradition"; Christmann, "Agrarschriftsteller"; Diederich, *Römische Agrarhandbücher*.

into Latin in 140 BCE. It consisted of twenty-eight books (papyrus scrolls) and was therefore equal in size to Columella's treatise of the first century CE.

From the Roman Empire, we have a series of Latin works produced from the second century BCE to the first century CE, all well known. The two earliest were produced by practitioners and based on their own experience, but also quoting predecessors. Marcus Porcius Cato the Elder composed *De agri cultura* (On Agriculture) between 170 and 150 BCE, a work of some 26,000 words; and Marcus Terentius Varro wrote his three-volume *Rerum rusticarum* (Of Rural Matters) in 37–30 BCE, a work of 62,000 words. Virgil's quite influential poem on farming, the *Georgica*, was authored between 32 and 29 BCE and comprise 23,000 words on agriculture. These were the precursors to Columella's *De re rustica* (On Rural Matters), a comprehensive work comprising 210,000 words, which he completed in 60–65 CE. All of these books were written in Italy, although Columella grew up in Roman Hispania and certainly drew on that experience. Finally, there is Pliny the Elder's *Historia naturalis* (Natural History), composed before 79 CE, an encyclopedia with five extensive sections on agriculture, amounting to 128,000 words.³⁸

A successor of these earlier Roman authors was Palladius, whose goal was to simplify earlier texts but also to codify his own experience as a landholder and farmer in Italy and other parts of the empire. He wrote his *Opus agricultura*, comprising some 80,000 words (ca. 55,000 in Latin), around 440–445 CE in southern Gaul.³⁹ Another influential source of agricultural knowledge was Bishop Isidore of Seville's encyclopedia, the *Etymologiae* (The Etymologies, 620–636).⁴⁰ Isidore devotes some 10,000 words to agriculture, across five sections of the book. The earliest preserved manuscript is very close to its time of composition, produced in the mid-seventh century, and the book remained immensely popular throughout the Middle Ages. The first printed edition was issued in Germany 1472 and there were ten further printed editions before 1500.⁴¹

In the regions of the eastern Roman Empire, several works from the second half of the first millennium are attested but now lost.⁴² Those works that have survived are often preserved in later manuscripts, including translations. A book by Vindonius Anatolius, written in Greek in fourth-century Beirut, was translated into classical Syriac (Aramaic) in the sixth or seventh century and into Arabic and Armenian in the tenth or eleventh: it has thus been preserved in these versions.

38 Pliny, *Natural History*, bks. VIII, XIV, XV, XVIII, and XIX.

39 Bartoldus, *Palladius Rutilius*, 7–34.

40 Butzer, "Classical Tradition," 554; Guzman, "Encyclopedias," 703.

41 Barney et al., "Introduction."

42 Schreiner, "Landwirtschaftliche Literatur:"

The work of Cassianus Bassus, composed in Greek around 600, is preserved in the later *Geoponika* (see below) and was translated into Arabic, Persian, and Syriac during the ninth century, and into Armenian around 1200.⁴³ A third work from this neighbourhood is the *Nabatean Agriculture*, which scholars now agree was compiled in or just before the sixth century.⁴⁴ It relates to local customs in Syria and was, to a large extent, preserved in an Arabic translation made by Ibn Waḥshiyya the Nabataean in 904, which can be regarded as a separate work (see also below).

The culmination of this Greco-Roman/Byzantine tradition is the aforementioned tenth-century *Geoponika*, a compilation produced in the imperial scriptorium,⁴⁵ comprising 90,000 words in the English translation. A version was translated into Arabic shortly afterwards, and parts were translated into Latin in the twelfth century. In the early sixteenth century, the full Greek text was published in Germany and several translations into European languages appeared at about the same time: Italian, French, German, and of course also Latin.⁴⁶ Angelo Carrara has claimed that this compilation is in fact a separate regional branch of the larger tradition, and can be traced back to the lost work by Mago of Carthage.⁴⁷

The contents of all these treatises reflect a Mediterranean agricultural system which had been well established for millennia before any texts were composed. In the works by Cato, Columella, and Pliny, the cultivation of wine vines and olive trees constitutes one fifth to one third of the whole text, and this is also true of the Nabatean text and the *Geoponika*. Arable farming is the subject of one to two tenths of the whole, and animal husbandry about as much. Varro's treatise is thus an outlier in this respect, since he devotes half his book to animal husbandry, with a focus on sheep and goats, but also including a long section on poultry.

The Islamic Tradition: Arabic Texts

A long research tradition surrounds the Arabic treatises on agriculture⁴⁸ and there is now a website dedicated to this literature and its manuscript sources: the

43 Sezgin, *Geschichte*, 314–18; Butzer, “Islamic Traditions,” 554; Hämeen-Anttila, *The Last Pagans*, 53. Manuscripts of Vindonius and Bassus are discussed by Carrara, “*Geoponica*.”

44 Hämeen-Anttila, *The Last Pagans*, 3–33; Hämeen-Anttila has also translated large parts into English.

45 Dalby, “Introduction.”

46 White, *Roman Farming*, 32, 45–46; Dalby, “Introduction,” 9–10.

47 Carrara, “*Geoponica*,” 105–6; Hämeen-Anttila, *The Last Pagans*, is open to that possibility.

48 Butzer, “Islamic Traditions”; see also the section on agriculture under “*Filāḥa*” in *The Encyclopaedia of Islam*.

Filāḥa Texts Project.⁴⁹ As noted above, these treatises have been discussed in the context of scholarly but also ideological debates over progress in the Islamicate world.⁵⁰ My survey is accordingly based on the Filāḥa Texts Project and the *Encyclopaedia of Islam*, as well as the work of other reputable scholars. Several of these Arabic treatises survive only in post-medieval copies. A notable exception is the *Nabataean Agriculture* of Ibn Waḥshiyya, of which fifteen manuscript witnesses survive from the tenth to the fifteenth centuries. As suggested above, this Iraqi polymath's additions to the original (lost) Nabatean text is so extensive that his can be regarded as an independent work.⁵¹ In total, the work is well over a hundred thousand words long.⁵²

The Islamic tradition's flourishing in al-Andalus is at first marked by a strong interest in botany: Fuat Segzin has listed twenty-five known botanical works from the ninth and tenth centuries alone.⁵³ This interest is further reflected in the fact that agricultural writers from eleventh and twelfth centuries collected plants and created botanical gardens. Karl Butzer has described their scientific observations as "unrivaled in medieval times," and Andrew Watson showed that these gardens preceded their equivalents in the other parts of Europe by centuries.⁵⁴ The focus on plants also underscores the fact that these treatises were part of a shared Islamic cultural heritage: for instance, the eleventh-century botanist Ibn Baṣṣāl recorded descriptions of plants he had encountered on the *hajj* (pilgrimage to Mecca).

A number of the Andalusian Arabic treatises exist in modern Spanish translations, and the word count below is based on those. Around 1000, an unidentified author composed a treatise comprising 10,000 words.⁵⁵ In the mid-eleventh century, another was authored by Ibn Wāfid, and a third of his text is preserved in a thirteenth-century Castilian translation; the translation into modern Spanish comprises 12,500 words, and the original would have been close to 40,000 words.⁵⁶ Ibn Baṣṣāl wrote his treatise, of some 56,000 words, in the late eleventh century. At about the same time, Abū'l-Khayr authored a book which

49 The Filāḥa Texts Project, www.filaha.org/.

50 Watson, *Agricultural Innovation*; Glick, "Agronomy"; Decker, *Tilling the Hateful Earth*.

51 Butzer, "Islamic Traditions"; Hämeen-Anttila, *The Last Pagans*, 33.

52 Hämeen-Anttila, *The Last Pagans*.

53 Segzin, *Geschichte*, 330–46.

54 Butzer, "Islamic Traditions," 27; Watson, "Arab and European Agriculture," 64–65.

55 *fi Tartīb Awqāt*.

56 Butzer, "Islamic Traditions," 22. The Castilian text is Ibn Wāfid, "La traducción castellana;" see also Ibn Wāfid, *Kitāb al-adwiya al-mufrada* (a translation into modern Spanish).

has been incompletely preserved, but what is left comprises 46,000 words in a Spanish translation.⁵⁷ (A little more than 4,000 words on the cultivation of olives and flax have been translated into English.)⁵⁸ The peak of this tradition came with a work put together by Ibn al-Awwām in the twelfth century, which comprises an astonishing 490,000 words in a modern French translation. Arabic treatises continued to appear in the Iberian Peninsula through the fourteenth century at least, even as the Muslim kingdoms were threatened and eventually eradicated by the “Reconquista.”⁵⁹ At the same time, the production of treatises gradually shifted eastward again. In Yemen, al-Malik al-Ashraf, who eventually became a Mamluk sultan (r. 1290–1293), composed a book describing agriculture in the region. An astronomical work by the same author also includes an almanac of agricultural information. A translation into English of the almanac comprise 5,000 words, about half about agriculture.⁶⁰ A hundred years later, the Rasulid sultan of Yemen, al-Malik al-Afḍal (r. 1363–1377), also wrote a treatise about farming. In the early modern period, the Islamic world did not experience the same rapid expansion in publication as China and Europe, though many works were produced or copied.

In general, the content of these Arabic treatises is dominated by the cultivation of fruit and vegetables. In Ibn Waḥshiyya’s translation and reworking of the *Nabatean Agriculture*, about half of the text concerns these subjects. According to Butzer, Ibn Baṣṣāl and Ibn al-‘Awwām devote two thirds of their texts to fruit and legumes.⁶¹ It should be noted that Butzer does not mention that arable farming is not included in Ibn Baṣṣāl, while Ibn al-‘Awwām includes a long section on horses. The earliest extant anonymous treatise from al-Andalus is almost totally focused on arboriculture and cultivated plants, and the same is true for the extant parts of the treatise by Abu’l-Khayr. Ibn Luyūn’s treatise, from the fourteenth century, devotes two-thirds of its text to vegetables and fruit. In the major treatises, viticulture is also important, though occupying slightly less than one tenth of the text.

The Filāḥa Texts Project includes some treatises which have not yet been edited, but its description of their contents confirms the conclusions above: Arab writers focused on plants and very seldom mentioned livestock or animal husbandry. The

57 Abū’l-Khayr, *Kitāb al-Filāḥa*.

58 See www.filaha.org/.

59 Ibn Luyūn, *Tratado de agricultura*.

60 Varisco, *Medieval Agriculture*, 23–40.

61 Butzer, “Islamic Traditions,” 18–19.

exceptions are Ibn al-'Awwām's long section on horses and other animals and also a few other works, such as that of the fourteenth-century Syrian author al-Dimashqī, who devotes about a tenth of his text to livestock, including doves and bees. The thirteenth-century Yemeni almanac of al-Malik al-Ashraf also contains a significant amount of information on camels.

The Islamic Tradition: Persian Texts, and an Unwritten Link to the East?

In the Persian lands of the Islamicate world, short entries on agriculture are included in encyclopedias from the tenth to the thirteenth centuries.⁶² At least two extant major works are also known.⁶³ The oldest of these was authored ca. 1310–1311 by the renowned and erudite vizier Rashīd al-Dīn, a Jewish convert to Islam.⁶⁴ The second, datable to 1515, was written by Qāsim Yūsuf and comprises 75,000 words; he also wrote a book on irrigation, half as long.⁶⁵ They can be regarded as one work, thus forming about 115,000 words together. As Maria Eva Subtelny has pointed out, both of these lengthy works date from two different periods of agricultural crisis, when nomadic conquerors destroyed crops and fields were neglected. Yūsuf and Rashīd al-Dīn therefore both underscore the importance of sustainable farming and the role of the peasantry.⁶⁶ Rashīd al-Dīn's text is largely devoted to gardening and arable farming (four tenths of the work), with sections on livestock, including poultry and bees (one sixth of the text). Irrigation was also an important topic for him, with one tenth of the text devoted to that subject.⁶⁷

The work of Rashīd al-Dīn, whose career flourished under the Mongol Ilkhanate, is also valuable for displaying some knowledge of Chinese agriculture. Thomas Allsen has shown that the vizier had personal contacts with Bolad Aqa, a Chinese-Mongolian administrator who served as supervisor of the department of agriculture at the Chinese court around 1300 and who then went to central Asia as

⁶² Vesel, "Les Traités d'agriculture," 99.

⁶³ Vesel, "Les Traités d'agriculture," 100; Lambton, "The *Āthār wa ahyā'*," 129; Subtelny, "A Medieval Persian Agricultural Manual," 168.

⁶⁴ Subtelny, "A Medieval Persian Agricultural Manual"; Lambton, "The *Āthār wa ahyā'*"; Allsen, *Culture and Conquest*; Ruymbeke, *Science and Poetry*.

⁶⁵ Subtelny, "A Medieval Persian Agricultural Manual"; Subtelny, "Mīrak-i-Sayyid Ghiyās"; Subtelny, "Agriculture and the Timurid Chahārbāgh." Professor Bo Utas has kindly counted the number of words in Persian at my request, and he also helped me with scholarly literature on Persian treatises. See Utas, "'Genres' in Persian Literature."

⁶⁶ Subtelny, "A Medieval Persian Agricultural Manual," 195–206.

⁶⁷ Lambton, "The *Āthār wa ahyā'*," 129–31. My estimation is based on the number of chapter headings.

a Chinese envoy. The knowledge of Chinese agriculture in Rashīd al-Dīn's treatise from the early fourteenth century could well be the result of this acquaintance.⁶⁸

Another indication of the intellectual flows between central Asia and China is a closely contemporary Chinese treatise written by the Uighur Lu Ming-Shan, who worked in the Chinese administration, though his treatise does not seem to convey any trace of his background in central Asia.⁶⁹

While there were certainly many such contacts between groups and individuals during the century of Mongol domination in Eurasia, and many oral and practical exchanges of information, we are still dealing with separate textual traditions.⁷⁰ The period of Mongol rule in China itself, the Yuan dynasty, also saw intensive exchanges of agrarian knowledge and technology there and throughout the Mongol khanates, such as the spread of carrot cultivation and the more common cultivation of cotton.⁷¹ Modern archaeology is producing more and more evidence of how these plants and technologies spread. Contacts and influences were occurring, but there were no direct cross-references between treatises. Why? A possible explanation is that, during these centuries, Chinese agriculturalists were focused on the large-scale dry cultivation and intensive cultivation of wet rice; whereas in central Asia, oases offering more occasional opportunities for irrigation was the more dominant praxis. A broader hypothesis could be that any praxis hardened into a fixed intellectual system—as in China—is less open to influence from other systems.⁷²

South Asian Treatises: Hindu and Indian-Islamic Traditions

Scholarly analysis of Indian agricultural treatises in the Hindu/Sanskrit tradition has been ongoing for quite some time.⁷³ So far, only two major agricultural treatises have been dated to the period before 1500 and both have been translated into English.⁷⁴ Why so few? When Irfan Habib initially wrote an entry on this topic in the 1965

68 Allsen, *Culture and Conquest*, 66–68, 115.

69 Bray, *Science and Civilisation*, 628. Allsen mentions the book by Lu Ming-Shan, but not that the author came from central Asia; see *Culture and Conquest*, 118.

70 See for instance, Fernandez-Armesto and Sacks, “Networks.”

71 Allsen, *Culture and Conquest*.

72 Cf. Needham, *Science and Civilisation*, 239, about medicine.

73 Raghvan, ed., *Agriculture in Ancient India*, 153–65; Randhawa, *A History*, 482–89; Ganguly, “Agricultural Technology”; Chaudhuri, “Agriculture.”

74 Kāshyapa, “A Sanskrit Work”; Kāshyapa, *A Treatise on Agriculture*; Kāshyapa, *A Sanskrit Work on Agriculture*; Parashara, *Krsi-Parashara*.

The Encyclopaedia of Islam, he asked this question; however, when his entry was republished in 2011, that paragraph was omitted.⁷⁵ Apparently, his earlier treatment had been interpreted as indicating that literate Hindu elites were uninterested in agriculture.⁷⁶ My conclusion is, rather, that agriculture was considered less *Literaturfähig* or “text-worthy” than in other ancient and medieval contexts.

In 1994, a group of Indian scholars founded the Asian Agri-History Foundation, in order “to facilitate dissemination of information on agricultural history” and research sustainable practices in South and Southeast Asia.⁷⁷ When I presented a first, preliminary version of this article in 2014 (online, via the Economic History website at Stockholm University),⁷⁸ it was met with some criticism from a leading scholar in this group, partly because my work was taken to suggest that the absence of Indian treatises before 1500 was an indicator of agricultural backwardness.⁷⁹ Here, I must once again stress that the number of extant treatises is not a sign of a more developed or sophisticated agricultural system. It could be that major agricultural treatises still lie dormant in the enormous and largely under-explored archives of South Asia.⁸⁰ In any case, even if the early extant works on agriculture are few, India must still be credited as a third independent birthplace of such works.

Extant manuscripts of the oldest texts identified to date are few, and were copied in the nineteenth and twentieth centuries. The dating of the original treatises is thus insecure and their authorship uncertain. Moreover, they have been attributed to legendary sages of the far-distant past, or to historical figures named after them; but these ancient sages were certainly not the authors.⁸¹ As Guyla Wojtilla emphasizes, “Sanskrit texts are notoriously difficult to date.”⁸² The agricultural treatise attributed to Kāśhyapa, the *Kasyapiyakrishisukti*, is preserved in a single and late manuscript. The original text has been dated to the second half of the first millennium CE,⁸³ and by some more precisely to the eighth or ninth century.⁸⁴ Wojtilla argues instead,

75 Habib, “Filāḥa, v. India”; Habib, “Agriculture and Irrigation.”

76 Mahias, “Présentations.”

77 See asianagrihistoryorg/about-us.htm.

78 Myrdal, *Agricultural Literature*.” Stockholm Papers Economic History no. 15, 2014, <https://swopec.hhs.se/suekhi>.

79 Nene, “Response to Comments” and “Final Comments; Myrdal, “Agricultural Literature in Eurasia before 1500.”

80 Pollock, *Language of the Gods*, 475, 558.

81 Wojtilla, “Introduction,” 9–10, 12.

82 Wojtilla, “Introduction,” 11.

83 Randhawa, *A History of Agriculture*, 484.

84 Wojtilla in Kāśhyapa, “A Sanskrit Work,” 85; Nene, “Commentary,” 132.

based on its many later interpolations, that the bulk of the text was composed in the later Middle Ages.⁸⁵ In my table, I have erred on the side of antiquity and placed it in the ninth century, though it could have been composed two or three hundred years later. In English it comprises, with the later interpolations, 22,000 words. The second text, the *Krishi-Parashara*, has also been assigned different dates: between the eleventh and sixteenth centuries,⁸⁶ or between the sixth and eleventh.⁸⁷ Claims to a far more ancient dating have also been made in publications of the Asian Agri-History Foundation.⁸⁸ I have tentatively placed it around the eleventh century. It comprises nearly 10,000 words, with one fifth devoted to animal husbandry and the remainder to arable farming, and significant attention to water management. Four fifths of the treatise ascribed to Kāśhyapa are also devoted to arable farming and water management, with the remainder divided almost evenly between animal husbandry and gardening and arboriculture. Nothing in either work indicates any contact with Arabic, Persian, or Chinese treatises.

Later extant South Asian agricultural treatises produced in the sixteenth and seventeenth centuries are offshoots of the Islamic tradition's Persian branch. The Asian Agri-History Foundation has published one with an English translation: *Nuskha dar Fanni-Falahat* (The Art of Agriculture). Its earliest manuscript dates from ca. 1700, but it was authored in the mid-sixteenth century, probably by the courtier Amanullah Husaini.⁸⁹ It is about 11,000 words long in the English translation and includes some discussion of wheat cultivation, but the text is dominated by fruit, vegetables, and arboriculture: very much in line with the Islamic-Arabic tradition. However, this and other Islamic-influenced treatises composed in South Asia reflect the growing conditions and climate of that particular region, and describe methods and plants suitable to the subcontinent; they therefore constitute a further and site-specific development of this tradition. Other treatises from the seventeenth and eighteenth centuries have also been preserved, and M. Majumdar mentions four and describes the contents of one.⁹⁰ Further references to still more treatises seem to indicate a quite extensive production of such texts in the early modern period.⁹¹ This

85 Wojtilla, "Introduction," 12–13.

86 Chakravarti, "Agricultural Technology," 223; Ganguly, "Agricultural Technology."

87 Parashara, *Krsi-Parashara*, xi, xvi; Chaudhuri, "Agriculture," 527.

88 Nene, "Agriculture in General," 81: prior to the fourth century BCE; Nene, "Commentary": between 100 BC and 100 AD.

89 Nene, "Foreword," vi.

90 Majumdar, "Risāka dar Falāhat."

91 Tauer, "Persian Learned Literature," 470; Habib, "Filāḥa, v. India," 910.

upsurge was connected with the keen interest which Mughal India's Muslim rulers took in the economy of the country, especially its agricultural base. One of the pillars of Eurasian agricultural history is the extremely detailed registration of agricultural products and productivity in northern India at the end of the sixteenth century.⁹²

The Chinese Tradition

Francesca Bray's seminal study of agricultural technology in premodern China (1984) includes a list of agricultural treatises, many of which she discusses in detail.⁹³ In 1993, Gang Deng published a study based on an analysis of these treatises. The list I offer in my Appendix draws on both works, among others, and the names of authors and their titles are spelled according to their scholarly conventions.⁹⁴

To date, only a few of these treatises have been translated into English or other European languages. However, there is a full translation of a richly illustrated encyclopedia from the end of the Ming dynasty, with a large section on agriculture, comprising about 11,000 words.⁹⁵ First published in 1637, it was reprinted in two further editions by 1644. (I quoted a passage on draft animals at the outset of this article.) Surviving manuscripts and printed editions of earlier treatises are generally dated much later than the original works. For example, a treatise from the sixth century CE is preserved in two eleventh-century manuscripts now in Japan and another in China, dating from the twelfth.⁹⁶ Other major treatises from the medieval period are preserved in printed editions from the sixteenth century and onward.⁹⁷ Complementing these extant texts, a longstanding bibliographical tradition bears witness to once-existing treatises. Deng's estimate of the total numbers, of which only about a third survive, is as follows: before the Han dynasty, 7; Han (202 BCE–220 CE), 14; diverse polities (221–580), 8; Sui and Tang (581–906), 52; Song and Yuan (960–1368), 133; Ming (1368–1644), 127; Qing (1644–1919), 199.⁹⁸

⁹² Habib, *The Agrarian System*; Habib, *An Atlas*.

⁹³ Bray, *Science and Civilisation*, 48–73, 621–33. Bray has returned to the agricultural treatises in a series of articles: see Bray, "Thinking with Diagrams," for further references.

⁹⁴ Deng, *Development versus Stagnation*. See also Fan "Some Outstanding Works"; Wilkinson, *Chinese History*.

⁹⁵ Sung, *Chinese Technology*; Bray, *Science and Civilisation*, 76; Deng, *Development versus Stagnation*, 45, on the importance of this work.

⁹⁶ Shih *A Preliminary Survey*, 1.

⁹⁷ Bray, *Science and Civilisation*, 49, 56, 60.

⁹⁸ Deng, *Development versus Stagnation*, 3; Bray, *Science and Civilisation*, 47; Wilkinson, *Chinese History*, 436, with slightly higher numbers.

Fan Chuyu has identified *Lü Shi Chun Qui* (Master Lü's Spring and Autumn Annals), dated to 239 BCE, as the earliest of the extant treatises.⁹⁹ This work is a compendium on natural philosophy which contains four essays on agriculture, and is included in my table.¹⁰⁰ A treatise by Fan Sheng-Chih, composed in the first century BCE, is now lost, but quotations in later works have enabled a reconstruction of a portion: once comparable in size to Columella's work, these remains comprise less than six thousand words in an English translation.¹⁰¹ Another work from the Han period, composed by Chui Shi in the middle of the second century CE, is also extant in fragments, which have been translated into English.¹⁰² What is left comprises 3,500 words, slightly more than half of which concerns farming. Because of its original length, it is also included in my table.

The earliest extant work of significant length is that of Jia Sixie (also spelled Chia Ssu-Hsieh), completed between 533 and 544 CE and consisting of some 100,000 characters.¹⁰³ Shih Sheng-Han has provided a detailed description of the contents, with a discussion and partial translation into English of the "original material": namely what Jia Sixie did not quote from other authors.¹⁰⁴ Half of the work is devoted to farming, and the rest mainly concerns household management, including culinary recipes.¹⁰⁵ (In the Appendix I have noted the length of the entire work, since I have not been able to read the full text or gain a thorough understanding its contents.) A book on ploughs, *Lei Ssu Ching* (Leisi Jing), written ca. 880 by Lu Kuei-Meng (Lu Guimeng) is the first detailed description of tools, which became an important feature of later Chinese treatises.¹⁰⁶ (It has already been mentioned as an example of those treatises excluded from the table due to its brevity: 693 characters.) While many of the

99 Fan, "Some Outstanding Works," 294. Deng, *Development versus Stagnation*, 49, refers to an even earlier treatise, which must be regarded as natural history as it is focused on soils.

100 Bray, *Science and Civilisation*, 48, 626–27.

101 For a translation, see Shih, "Fan Shêng-Chih Shu"; Bray, *Science and Civilisation*, 51, for estimation of original size.

102 Translation in Hsu, *Han Agriculture*, 215–18; about the book, see Bray, *Science and Civilisation*, 630 and Wilkinson, *Chinese History*, 437.

103 Bray, "Thinking with Diagrams," 11.

104 Shih, *A Preliminary Survey*, 31–99.

105 The estimation is based on the proportions of chapters/entries devoted to different subjects: Bray, *Science and Civilisation*, 57, mentions ninety-two chapters; Deng, *Development versus Stagnation*, 63, ninety-four entries. Shih, *A Preliminary Survey*, 3–5, enumerates ninety-two chapters.

106 Deng, *Development versus Stagnation*, 75–76; date of composition in Bray, *Science and Civilisation*, 646.

other surviving treatises largely consist of quotations from earlier works, some are highly original: for example, the treatise written by Chhen Fu (Chenfu) in 1149, consisting of some 12,500 characters.¹⁰⁷ Chhen Fu is critical of earlier authors, especially Jia Sixie, who focused on conditions in northern China and on the dry farming of millet and barley (though rice is also mentioned). By contrast, Chhen Fu describes areas dominated by wet rice cultivation around the Yangtse,¹⁰⁸ thus reflecting a major southward shift in China's economic centre and the increased importance of rice: a shift that became definitive around 1000.¹⁰⁹

One of the most popular works, *Keng Chih Thu* (Tilling and Weaving), was first presented to the emperor in 1145 as a series of images, accompanied by a long poem (comprising some 3,000 words in an English translation) that offers detailed descriptions of these processes. The text and images continued to be widely reproduced in the post-medieval era.¹¹⁰ An official treatise promulgated by the board of agriculture in 1273, *Nung Shan Chi Yao* (Fundamentals of Agriculture and Sericulture), has come down to us only in later editions which comprise 60,000 characters.¹¹¹ Another extensive work of this era was composed by Wang Shen in 1313, and comprises 110,000 characters.¹¹² Four fifths is devoted to farming, and the rest to other tasks such as textile production. The longest treatise of all is technically post-medieval, authored by Hsü Kuang-Chhi (Xu Guangqi), who died and left the work unfinished in 1633. Entitled *Nung Cheng Chhüan Shu* (Complete Treatise on Agriculture), it was completed by a group of scholars and published in 1639, weighing in at a stunning 700,000 characters. Around one quarter of the total is devoted to famine relief; the rest concerns farming.¹¹³

Significantly, many of these works were composed during unsettled times of agricultural crisis: a period of political fragmentation in the sixth century, in the midst of Mongol rule, and during a cruel civil war in the seventeenth century. Others were written during periods of economic expansion, especially during the

107 Fan, "Some Outstanding Works," 299–300; Deng, *Development versus Stagnation*, 78–82.

108 Bray, *Science and Civilisation*, 48.

109 Bray, *Science and Civilisation*, 9, 427; Deng, *Development versus Stagnation*, 30–31.

110 Hammers, *Pictures of Tilling*, lists the manuscripts and variants and includes an edited version from ca. 1275, copied into an eighteenth-century manuscript; here, the poem comprises 1,883 characters, of which 878 concern field agriculture and the rest sericulture. See also Bray, *Science and Civilisation*, 49.

111 Bray, *Science and Civilisation*, 71–72.

112 Bray, *Science and Civilisation*, 59–64; Deng, *Development versus Stagnation*, 82–85.

113 Bray, *Science and Civilisation*, 64–67; Deng, *Development versus Stagnation*, 86–90.

twelfth and thirteenth centuries. This long and continuous flow of documentation for one major Eurasian region thus facilitates a comparison of changing trends over time, mirroring major agrarian changes over a *longue durée*,¹¹⁴ such as the shift to rice cultivation before the eleventh century. Although the earliest treatises from the centuries before and after the beginning of the Common Era appear to be dominated by arable farming, this focus reflects the interests of later authors who quoted excerpts from these works, and does not necessarily capture their original range of interests. In the preserved text of *Fan Sheng-Chih*, from the first century BCE, about one fifth is devoted to gardening, animal husbandry, and sericulture, and the rest to arable farming.¹¹⁵ In the treatises from the sixth century onward, three to four tenths (about one third) are usually devoted to arable farming, and about as much to gardening and arboriculture. Water management was not treated as significant in the earliest treatises but became a topic of increased interest in treatises from the thirteenth century onward, comprising one tenth to a fifth of these texts. Animal husbandry, which in the two latest treatises (1313 and 1633–1639) is dealt with briefly or not at all, occupies one tenth of the earlier treatises. Attention to sericulture was not prominent in the work of Jia Sixie (ca. 540 CE) or in Chhen Fu's 1149 treatise, but increases to between one tenth and one fifth in lengthy works from the twelfth to the seventeenth century, while occupying more than half of the long poem from 1145. Entire monographs on tea production had already been produced during the second half of the first millennium CE (see Appendix). After around 1600, when new crops from the Americas were being introduced into China, these innovations are reflected in both major treatises and in separate monographs.

Meanwhile, Chinese treatises were themselves being exported: to Korea and Japan during the Tang and Song dynasties (before and around 1000), and later to Southeast Asia.¹¹⁶ They also generated local offshoots. The first works written in Korean date to the fifteenth century, when the state developed a simpler writing system in order to promote more widespread literacy; the production of agricultural treatises was connected to this program. The most important was *Nongsa jikseol* or *Straight Talk on Farming*, compiled in 1430. Another book that circulated as an

114 My analysis of the medieval treatises is hampered by the lack of complete translations, but Bray and Deng have calculated the amount of attention devoted to each topic based on the number of chapters in those dated to 535, 1149, 1273, 1313, and 1637: Bray, *Science and Civilisation*, 57, 61, 66, 71; Deng, *Development versus Stagnation*, 63, 78–79, 87.

115 That is, about 15 percent on gardening and arboriculture, 4 percent on animal husbandry, 6 percent on sericulture, and the remainder dealing with soils, arable husbandry, and general topics.

116 Deng, *Development versus Stagnation*, 123, 134.

appendix to this treatise—in reality, a separate work—was produced at the end of this century. (Both are included in my table.) They also inspired newer works.¹¹⁷ Japanese treatises in this tradition are post-medieval, although an agricultural manual included in a book on military campaigns from the late seventeenth century may contain older elements from the sixteenth century.¹¹⁸ The first comprehensive Japanese treatise appeared in 1697, according to the writer's own declaration.¹¹⁹ At this time, further treatises had been produced in Korea and in China as well.

Chinese treatises were often richly equipped with images, and illustrated works survive in printed copies from as early as the twelfth century. The first long and fully illustrated work was the lengthy treatise of Wang Chen (1313),¹²⁰ and this was followed by a whole series of others. Obviously, these illustrations are an extremely important resource for the historian, especially since there are very few in treatises from elsewhere in Eurasia. That said, many images of agrarian activity appear in manuscripts and other contexts, for instance in botanical works.¹²¹ In Byzantium, manuscripts of Hesiod were illustrated with farming scenes,¹²² and several illustrated manuscripts of Columella, Pliny, and Virgil (among others) were produced in later medieval Europe.¹²³

Latin Christendom after 800 CE

The medieval tradition of agricultural writing in Latin Europe has long been the subject of research.¹²⁴ Most major treatises have been edited and published in modern translations. The number of extant manuscripts grows from very few around the year 1000 to mass production at the end of the Middle Ages, in keeping with wider documentary trends. In contrast to the other medieval regions we have surveyed, the earliest manuscript copies of medieval European treatises were often produced quite close to the time of their original composition.

In England, short texts on estate management were produced in the ninth and tenth centuries (in Old English with Latin translations) and are preserved

117 Lee, *A New History of Korea*, 193, 195, 240–41.

118 Smith, *Agrarian Origins*, 89; Farris, *Japan's Medieval Population*, 224–25.

119 Smith, *Agrarian Origins*, 87–93; Bray, *Science and Civilisation*, 625–27.

120 Bray, "Thinking with Diagrams," 16–20.

121 Mane, *Le Travail à la campagne*.

122 Schreiner, "Landwirtschaftliche Literatur."

123 Mane, *Le Travail à la campagne*, 46–50.

124 Frauendorfer, *Ideengeschichte*; Fussell, *Classical Tradition*.

in manuscripts from the twelfth century.¹²⁵ They were precursors to a genre that flourished at the end of the thirteenth century, when a number of closely related treatises on manorial accounting appeared in Latin and Anglo-Norman French: we encountered one of them at the beginning of this article. These texts are so specific to their insular context that medieval England could well be considered an independent birthplace of the agricultural treatise. Indeed, thousands of account rolls from the thirteenth through fifteenth centuries have been preserved, from hundreds of English manors. They form one of the finest source materials for the detailed study of farming praxis in all of premodern Eurasia.

Three agricultural treatises in particular were widespread as practical handbooks for those who managed manorial estates. All were written in French and all are interrelated, though they differ in structure and emphasis. Dorothea Oschinsky has edited the original texts, and has also translated two into modern English; for the third, by Walter of Henley, she reprinted a 1508 English edition.¹²⁶ Two, the anonymous *Seneschauchie* (Stewardship) and *Le dite de hosebondrie* (Discourse on Husbandry) attributed to Walter, date from around 1280 and comprise more than seven thousand words each. The third, *Ceo est hosebondrie* (This Is about Husbandry) from the end of that century, is half as long. Around seventy medieval manuscripts have survived, in total, and more than half are copies of Walter of Henley's treatise. Although none of these works quote older Roman authors, George Fussell once speculated that the English authors had read some classical texts.¹²⁷ This is questionable, however, considering that manorial accounting was taught outside the scholastic milieu, and even at contemporary universities the classical agricultural writers were largely unknown. Rather, it is clear that these treatises reflect local traditions, not the Mediterranean farming techniques of antiquity. One further text has come down to us in a single copy, the so-called *Scriptum quodam* (Certain Writing) from Gloucester Abbey: the incipit of a set of instructions included in the monastery's cartulary and compiled in the second half of the thirteenth century. It comprises around 2,500 words and, due to its brevity, is not included in my table.¹²⁸

125 Banham and Faith, *Anglo-Saxon Farms*, 8–9.

126 Oschinsky, *Walter of Henley*. Oschinsky also edited a further treatise from the first half of the thirteenth century, mainly about manorial administration. For some corrections of these translations, see Harvey, "Agricultural Treatises," 180–82.

127 Fussell, *Classical Tradition*, 65.

128 *Historia et cartularium* 1867, xcvi–c, 213–21. For a discussion and dating of the document, see Hilton, *A Medieval Society*, 86–87.

Classical texts reached Christian Europe along two paths: via late antique or Carolingian copies of Latin authors or via translations from extant Greek texts by Arabic scholars. In al-Andalus, Ibn Wāfid's Arabic treatise was translated into Castilian in the thirteenth century and later influenced the work of Gabriel Alonso de Herrera, published in 1513 (see below).¹²⁹ From the ninth to the thirteenth century, we also have works by medieval authors, like the Benedictine monk Wandelbert of Prüm (813–ca. 850) and the Dominican theologian Albertus Magnus (ca. 1193–1280), both of which contain short sections on agriculture with reference to classical authorities (not included in the table).¹³⁰ The first major agricultural work created in the medieval period on the Continent was that of the Bolognese jurist Pietro de' Crescenzi (also known as Petrus de Crescentiis), composed in the first decade of the fourteenth century. Entitled the *Ruralia commoda* (Rural Rewards), it comprises some 140,000 words in the Latin original (around 220,000 words in a modern German translation).¹³¹ This work survives in more than one hundred and thirty manuscripts, the earliest being from 1339. In the fourteenth century, it was translated into Italian, French, and German. In the late fifteenth century, it was again translated into German and saw further translations into Czech, Polish, and Russian.¹³² Crescenzi based much of his work on Palladius and he also quoted other Roman authors, but he had not read Columella directly (though he knew of his works). The famous Muslim philosopher Ibn Sinā (Avicenna, ca. 980–1037) was also one of his main sources, although Crescenzi does not mention the Arabic agronomists and may not have had any direct knowledge of their works.¹³³ This was also the first agricultural treatise to be printed in Europe, published at Augsburg in 1471, with eight reprints following before 1500.¹³⁴

The medieval French translation of Crescenzi's book was commissioned by King Charles V (r. 1364–1380), who also commissioned a treatise specifically dedicated to animal husbandry as a supplement. The author of the latter was Jean de Brie, a former shepherd; presumably, he had some help in composing it. Published in 1379, this book survives in a printed edition from the early sixteenth century, with a number of later additions. It comprises some 20,000 words in both Old French

129 Colin, "Agriculture (Ar. *filāḥa*)," 7.

130 Butzer, "Classical Tradition," 562–78; Frauendorfer, *Ideengeschichte*, 58–60.

131 Crescentiis, *Erfolgreiche Landwirtschaft*.

132 Mane, *Le Travail à la campagne*, 32; Vollman, "Einleitung."

133 Comet, "Le Statut intellectuel," 29; Glick, "Agronomy."

134 Fussell, *Classical Tradition*, 92; Vollman, "Einleitung," 9.

and modern English translation.¹³⁵ In the fifteenth century, two longer agricultural treatises appeared in Italy, by Corniolo della Cornio and Michelangelo Tanaglia.¹³⁶

The fifteenth century was characterized by a renewed interest in the classical authors, in keeping with wider humanist intellectual trends. There are a hundred known manuscripts of Palladius and forty of Columella's treatise from this time.¹³⁷ Palladius was also translated into English (1442)¹³⁸ and Columella into Swedish (ca. 1520).¹³⁹ Printing further spread the circulation of older texts, as we noted above in our discussion of Isidore and the *Geoponika*. Pliny the Younger's work was printed in dozens of editions in the late fifteenth century; Columella's four times; and an anthology including the works of Varro, Columella, and Palladius eleven times.¹⁴⁰ Printing also meant that more books were illustrated with woodcuts and engravings, both classical authors and the work of Crescenzi.¹⁴¹ In the sixteenth century, newer treatises also appeared in print. Gabriel Alonso de Herrera's *Obra de Agricultra* (250,000 words) was first published in 1513, with many later and expanded editions to follow.¹⁴² After Walter of Henley's treatise, printed for the first time 1508,¹⁴³ the *Boke of Husbandry* by the jurist Anthony Fitzherbert (1470–1538), the first new treatise in English, was published just beyond the chronological scope of this article, in 1523; the 1534 edition is available online and comprises 53,000 words.¹⁴⁴ It contains no references to previous authors, except in Fitzherbert's moralizing final section, where he mentions some classical authorities (though not the agricultural writers).

With respect to their contents, it is obvious that these European treatises reflect two very different agricultural systems: that of the Mediterranean littoral and that of northwestern Europe. Crescenzi, in the early fourteenth century, and

135 Brie, *The Medieval Shepherd*.

136 Comet, "Le Statut intellectuel," describes Cornio's treatise; Mane, *Le Travail à la campagne*, 53, also mentions Tanaglia.

137 Josephson, *Die Columella-Handschriften*; Hedberg, *Contamination and Interpolation*.

138 Ficht, "Introduction."

139 Granlund, *Peder Månssons Bondakunst*: the classical text is adjusted and supplemented to suit northerly conditions.

140 Beutler, "Un Chapitre de la sensibilité," 1297.

141 Mane, *Le Travail à la campagne*, 46–54.

142 For an abbreviated translation into English of a later edition, see Herrera, *Ancient Agriculture*; the later editions also exist in modern Spanish reprints.

143 Published, as noted above, by Oschinsky, *Walter of Henley*.

144 Master Fitzherbert: Internet Archive www.archive.org/details/bookofhusbandry00fitzuoft.

Herrera, two hundred years later, describe the former. Their sections on fruit trees, viticulture, and gardening constitute about half of their works, with one quarter devoted to animal husbandry and the remainder mainly to field farming.¹⁴⁵ They are thus closer to their Roman predecessors than to the medieval Arabic authors in their attention to animal husbandry. For northern Europe, Jean de Brie's French supplement to Crescenzi's work represents an important step toward addressing the vital praxis of sheep farming, which was so central to the entire northwestern European economy. The three treatises from late thirteenth-century England each devote about half of their text to animal husbandry and the rest to arable farming (two fifths to livestock for Walter of Henley, and three fifths for the two others). The short text from Gloucester has the same focus. Two hundred years later, Fitzherbert's *Boke of Husbandry* is nearly half about arable farming, nearly half about animal husbandry, and less than one tenth dedicated to gardening.

A Test of the Iceberg Method

One subset of the treatises from medieval Europe can serve as a case study for testing the Iceberg Method introduced at the beginning of this article: works produced in Sweden. I have read virtually all of the existing medieval documentation on agriculture extant in Sweden (charters, law codes, miracle stories, etc.) and a fair portion of the sixteenth-century sources, too. In other words, I know not only the tip of the iceberg, but also almost everything submerged below the surface. The first short texts on farming in Sweden appear in the late fifteenth century. In the first years of the sixteenth, a Swedish translation of Columella was published. Also in the sixteenth century, shorter works of instruction multiplied, while the first long agricultural treatise was authored and disseminated in manuscript during the second half of that century.¹⁴⁶ In the sixteenth century, manorial accounts (compiled on state-owned manors) were produced to an extent comparable with the situation in later medieval England. With some delay, then, Sweden followed the general European pattern. The first printed books on agriculture did not appear until the end of the seventeenth century, as in other countries on Europe's northern periphery.

The methodological takeaway, then, is that the tip of the Swedish iceberg—that first long treatise from the sixteenth century—represents an increasing *textual* interest in agriculture: the moment when it became *Literaturfähigkeit*, worthy of its own literature. Hence, I posit that the Iceberg Method is a more generally applicable way to measure the emergence of other textual genres and therefore

¹⁴⁵ Butzer, "Islamic Traditions," 19.

¹⁴⁶ Myrdal, *Medeltidens åkerbruk*; Myrdal, *Boskapsskötsel*.

to achieve comparable data sets for global history. Rather than relying on a few chosen examples, it helps to reveal deeper processes and times of profound change.

Conclusions

As for so many other innovations, the first glimpse of a written tradition of agricultural knowledge is quite early: a brief Sumerian text from Mesopotamia, ca. 1800 BCE. Another written tradition then arose in Greece, nearly three thousand years ago. However, continuous traditions of agricultural writing in the major regions of Eurasia did not begin until the third century BCE. The survey presented here demonstrates that agricultural treatises then emerged in two different regions independently and simultaneously: in the eastern Mediterranean and in China. During the Middle Ages, this genre also emerged independently in India. I have also observed that the specific conditions of manorial management and pragmatic literacy in thirteenth-century England could be regarded as a fourth independent invention of this genre.

The continuity of the two great traditions in eastern and western Eurasia is more visible in China, where the production and dissemination of treatises was often fostered by centralized imperial authority. In western regions, we encounter an assiduous process of writing, rewriting, and innovation, though with a shifting geographical trajectory. From Greco-Roman antiquity this genre spread to—and was preserved in—the eastern Roman Empire and in the Islamicate world: early in al-Andalus and then in the Levant (Syria, Yemen), Persia (including modern-day Afghanistan), and finally in early modern India, where the Islamicate textual tradition apparently overwhelmed existing Hindu traditions. Meanwhile, a post-classical genre of agricultural writing in Latin Christian Europe developed relatively late. Here, too, the influence of Arabic authors from al-Andalus is evident, alongside the reception of Roman authors. England represents its own unique insular tradition, developing in close connection with management of a manorial economy. In all of the major regions, there was a gradual increase in textual production around 1000 CE, again in keeping with broader trends.

The content of all these treatises reveals constant adjustment to regional agricultural systems and environmental factors. However, it was also shaped by longstanding preferences that developed in the separate branches of the great traditions, the focus on botany in Islamic treatises being a significant example. Changes in farming practices also entailed an ongoing reformulation of their content, as when treatises from Mediterranean had to be adapted to the conditions of northern Europe, or as wet rice cultivation in southern China displaced millet farming in the northern parts of the empire.

An abiding enigma is the lack of apparent interconnection between these two great Eurasian traditions, even though we know that there were many opportunities and occasions for contact. Intellectual influences, technologies, and plant and animal species moved with trade and conquest throughout this vast area—but not treatises as such. This is partly explained by the fact that two different ways of documenting agricultural praxis had already developed over a long period of time. In other words, both traditions had reached a high degree of intellectual crystallization, which may have stalled the written transmission of that information.

This leads to my grand hypothesis. The agricultural treatises that have come down to us reflect an increasingly systematic approach to agriculture in much of Eurasia from the middle of the first millennium BCE onward. From around the sixth century BCE to the second century CE, more complex and integrated agricultural systems were forming: iron not only replaced bronze but also paved the way for the invention of a whole new farming tool kit. Meanwhile, the long and intricate chains of trade had been developing since the beginning of the Bronze Age, in part because the copper and tin necessary for the production of bronze were only to be found sparsely and in widely separated regions. Even though iron is more readily available in many places, its advent in the long run actually intensified interregional trade, because of increased surplus production. At the same time, the geographical division of labour became not only an asset but a necessity for all agricultural enterprises. After the sixth century BCE, the market for iron expanded on both the regional and local level, while long-distance trading networks continued to flourish, now more focused on luxury products. Because iron was needed by many more users and had many more functions, metallurgy ceased to be something rare and became a common technology. Not only the forging of metals, but a range of other crafts developed and innovated dramatically and rapidly, such as carpentry: again with a new iron tool kit. New and more efficient agricultural tools and methods became widespread. All of these changes led to more complex modes of agricultural production and more specialization.

At the same time, the scale of political organization grew alongside the development of allied military technologies (infantry with a mass of soldiers armed with iron weapons), with expanding administrations demanding heavier taxes, which also effected agricultural change. At the level of the farm, these and other factors meant there was a need for a different kind of ingenuity and longer-term planning. Farming units became more directly integrated into economic systems that spread over enormous regions. The global agricultural systems as we know them emerged and developed in a path-dependence fashion: intensive wet rice cultivation in East Asia, diversified Mediterranean agriculture designed to withstand the summer

drought, and the northern European reliance on animal husbandry integrated with arable farming.¹⁴⁷

All of these changes, which began in the middle of the first millennium BCE, could have made it necessary to conceptualize agriculture in a more systematic way. According to my hypothesis, this is what made agriculture *Literaturfähig*, something worth writing about. Hence the emergence of the two great traditions that prevailed until the early modern period, with some important changes—again on a pan-Eurasian plane—around 1000 CE. To some extent, this grand hypothesis is related to scholarly discussions about “Axial Ages”¹⁴⁸ marked by an increasing historical reflexivity and awareness of change. However, those who advocate for such theories often lack hard data to sustain their arguments.¹⁴⁹ Here, I present such a data set, from a totally different perspective than religion and philosophy, but contemporaneous to that of a presumed Axial Age.

The main goal of this article is not, however, to support these overarching and tantalizing theories. Rather, it is to offer a useful data set (see the Appendix) and synthesis of our state-of-the-art knowledge regarding the composition and circulation of agricultural treatises in Eurasia over the span of two millennia. In so doing, it has also shown how and when agricultural knowledge became something that required documentation, thus making a contribution to the ongoing study of pragmatic literacy.

147 Grigg’s *Agricultural Systems* is still the best work on the history of agricultural systems; on parallel processes in Eurasia see Lieberman, *Strange Parallels*.

148 See, for instance, Eisentadt, *Origins and Diversity*.

149 Myrdal, “On Source Criticism,” 70–79. For a statistical test of some of the features, see Mullins et al., “A Systematic Assessment.”

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Abstract This article analyzes all extant agricultural treatises produced before the sixteenth century throughout Eurasia, in order to highlight their importance for the study of agricultural praxis, their significance for constructing a transnational intellectual history of the medieval globe, and their relevance for the development of pragmatic literacies. Such texts emerged both in China and around the Mediterranean before 200 BCE, and somewhat later in India, but few have been preserved and many are difficult to date. Thereafter, the medieval transmission of agricultural knowledge moved via several different regional trajectories and traditions, with Anglo-Norman England becoming a fourth and largely independent birthplace of the agricultural treatise genre during the thirteenth century. The proliferation of these texts becomes evident throughout Eurasia around 1000 CE and increases further from the fourteenth onward. Throughout this *longue durée*, the contents of these treatises reflect real changes in agricultural technologies, dominant crops, and climate.

Keywords intellectual history, economic history, agriculture, agricultural treatises, Roman Empire, Byzantium, Islamic world, China, India, medieval Europe, England, pragmatic literacy, manuscript studies, history of the book.

Appendix

THE MAJOR AGRICULTURAL TREATISES OF PREMODERN EURASIA

The regional and chronological entries below consist of (approximate) dates, authors (when known), conventional titles, language, place of origin or publication, approximate length of text devoted to agriculture (in words or Chinese characters), and an indication of known translations into modern English (√) if not otherwise stated. (A preliminary version of the list has been published online: Myrdal, *Agricultural Literature in Eurasia*. I have since made several additions and amendments.)

The spelling of proper names has been determined by the scholars cited in the bibliography. Note: not all works listed here are discussed in the accompanying article. For translations of the Chinese titles, see Bray, *Science and Civilization*, and for the Arabic titles see www.filaha.org/.

The word count is based in translations into modern English, and otherwise to major European languages (French, Spanish, German), because they give a similar result regarding the number of words. For one treatise the number of words in Persian has been counted. For the Chinese treatises, the number of characters has been presented by scholars, but in translations to modern English the number of words is normally ca. 50–60 percent higher than the number of characters.

Date	Author	Title	Language	Locale	Length ¹⁵⁰	Translation ¹⁵¹
Greco-Roman Tradition						
ca. 700 BCE	Hesiod	<i>Erga kai Hēmerai</i>	Greek	Attica	5,000	√
after 362	Xenophon	<i>Œconomicus</i>	Greek	Attica	12,000	√
170–150	Cato the Elder	<i>De agri cultura</i>	Latin	Latium	26,000	√
37–30	M. Terentius Varro	<i>Rerum rusticarum</i>	Latin	Latium	62,000	√
32–29	Virgil	<i>Georgics</i>	Latin	Italy	23,000	√
60–65 CE	Columella	<i>De re rustica</i>	Latin	Italy/Iberia	210,000	√
before 79	Pliny the Elder	<i>Naturalis historia</i>	Latin	Italy	128,000	√
4th c.	Vindonius Anatolius	[agricultural practices]	Greek	Syria		
440–445	Palladius	<i>Opus agriculturalæ</i>	Latin	Italy/Gaul	80,000	√
ca. 500	Anonymous	<i>Nabatean Agriculture</i>	Aramaic	Syria	100,000+	√ (partial)
ca. 600	Cassianus Bassus	agricultural treatise	Greek	West Asia		
620–636	Isidore of Seville	<i>Etymologiae</i>	Latin	Iberia	10,000	√
mid-10th c.	Anonymous	<i>Geoponika</i>	Greek	Byzantium	90,000	√
Islamic Tradition						
904	Ibn Waḥshiyya	<i>Transl. Nab. Ag.</i>	Arabic	Iraq	100,000+	√ (partial)
ca. 1000	Abi 'l-Jawwad (?)	<i>Kitāb fi tartīb</i>	Arabic	Iraq	10,000	Spanish
11th c.	Ibn Wāfiḍ	<i>Majmu fi 'l-filaha</i>	Arabic	Iberia	12,500 extant	Spanish

150 As estimated in words (Indo-European languages) or Chinese characters.

151 √ indicates the existence of an English translation; other translations into European vernaculars as indicated.

1070–1075	Abu l-Khayr al-Ishbili, <i>Kitab al-filāha</i>	Arabic	Iberia	46,000 extant	Spanish (partial)
ca. 1100	Ibn Baṣṣāl <i>Dwān al-filāha</i>	Arabic	Iberia	56,000	Spanish
1100–1110	al-Thighnari <i>Zuhrat al-bustān</i>	Arabic	Iberia		
1175–1200	Ibn al-'Awwam <i>Kitab al-filāha</i>	Arabic	Iberia	490,000	French
late 13th c.	al-Malik al-Ashraf <i>Milhal-malaha</i>	Arabic	Yemen		
	al-Malik al-Ashraf almanac			5,000	√
early 14th c.	al-Dimashqi <i>Al-Durr al-multaqit</i>	Arabic	Syria		
1310–1311	Rashid al-Din <i>Athar wa ahiya</i>	Persian	Iran/ Afghanistan		
1300–1350	Ibn al-Raqqam <i>Kitab khulasat al-ikhti</i>	Arabic	Iberia		
1348–1349	Ibn Luyūn <i>Kitab ibda</i>	Arabic	Iberia	24,000	Spanish
14th c.	Anonymous <i>Miftah al-raha</i>	Arabic	Syria		
1350–1375	al-Malik al-Afdal <i>Bughyat al-fallahin</i>	Arabic	Yemen		
late 14th c.	al-Tamâr-Tamuri <i>Al-Filaha</i>	Arabic	Egypt		
ca. 1500	al-din-Ghazzi al-amiri <i>Jami fara'id al milaha</i>	Arabic	Syria		
1515	Qasim Yusuf <i>Irsha al-Zira'a</i>	Persian	Iran/ Afghanistan	115,000	
Indian (Hindu Sanskrit) Tradition					
9th c. (?)	[Kāshyapa] <i>Kashyapiyakrishisukti</i>	Sanskrit	India	22,000	√
11th c. (?)	[Parashara] <i>Krishni-Parashara</i>	Sanskrit	India	10,000	√
Chinese Tradition					
239 BCE	Lü Pu-Wei et al. <i>Lü Shih Chun Chhiu</i>	Chinese	China		

(continued)

Date	Author	Title	Language	Locale	Length	Translation
32–37 CE	Fan Sheng-Chih	<i>Fan Sheng chih shu</i>	Chinese	China	~4,000 characters extant	√
ca. 160 CE	Chui Shi, 160 CE	<i>Ssu-Min-Yüeh-Ling</i>	Chinese	China	~2,500 characters extant	√
533–44	Jia Sixie	<i>Chhi Min Yao Shu</i>	Chinese	China	100,000 characters	√ (partial)
686	Anonymous	<i>Chao Jen Pen Yeh</i>	Chinese	China		
ca. 750	Han O	<i>Ssu Shih Tsuan Yao</i>	Chinese	China		
770	Lu Yü	<i>Chha Ching</i> (on tea)	Chinese	China		
1060	Tshai Hsiang	<i>Ccha Lu</i> (on tea)	Chinese	China		
1060	Wen-Jung	<i>Hsiang Shan Yeh Lu</i>	Chinese	China		
late 11th c.	Tscheng An-Chih,	<i>Ho Phu</i>	Chinese	China		
1145	Lou Shou	<i>Keng Chih Thu</i>	Chinese	China	3,000	√
1149	Chhen Fu	<i>Nung Shu</i>	Chinese	China	12,500 characters	
1154	Wang Cho	<i>Thang-Shuang Phu</i>	Chinese	China		
late 12th c.	Tung Wei	<i>Chiu Huang Huo Min</i>	Chinese	China		
ca. 1250	Wu I or Tsuan,	<i>Chung I Pi Yung</i>	Chinese	China		
1275	Chang Fu	<i>Chung I Pi Yung</i>	Chinese	China		
1273	Meng Chi et al.	<i>Nung Sang Chi Yao</i>	Chinese	China	60,000 characters	

1301	Hsiung Tsung Li (?)	<i>Chü Chia Pi</i>	Chinese	China	
1313	Wang Chen	<i>Nung Shu</i>	Chinese	China	110,000 characters
1314	Lu Ming-Shan (Uighur)	<i>Nung Sang I Shi</i>	Chinese	China	
14th c.	Chhang-Ku Chen-I	<i>Nung Thien Yü</i>	Chinese	China	
1502	Kuang Fan (?)	<i>Pien Min Thu Tsuan</i>	Chinese	China	
1504	Sung Hsu	<i>Shu Hsü Pu</i>	Chinese	China	
Korean Tradition					
1430	Anonymous	<i>Nongsa chikcsöl</i>	Korean	Korea	
1491	Kang Hûi	<i>Nongsa chikcsöl</i>	Korean	Korea	
Western European (Christian) Tradition					
ca. 1275	Anonymous	<i>Seneschaucie</i>	French	England	7,500 ✓
ca. 1285	Walter of Henley	<i>Le dite de hosebondrie</i>	French	England	7,200
1290–1300	Anonymous	<i>Ceo est hosebondrie</i>	French	England	3,800 ✓
1304–1306	Pietro de' Crescenzi	<i>Ruralia commoda</i>	Latin	Italy (Bologna)	220,000 German
1379	Jean de Brie	<i>Le bon berger</i>	French	northern France	20,000 ✓
15th c.	Corniole della Corghna	<i>Divina villa</i>	Italian	Italy	
ca. 1500	Michelangelo Tanaglia	<i>De agricultura</i>	Italian	Italy	
1513	Gabriel de Herrera	<i>Obra de agricultura</i>	Spanish	Spain	250,000 ✓ (partial)

