Antonio Saltini

AGRARIAN SCIENCES IN THE WEST

translated by Jeremy J. Scott

VOLUME ONE

From Early Mediterranean Civilisations to the European Renaissance

Preface by Luigi Luca Cavalli Sforza and Dario Casati

Nuova Terra Antica

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In memory of Beatrice Falzoni Macchiavelli
for the immeasurable passion she dedicated to teaching Italian
to a sickly schoolboy who would be
absent from school for months at a time.

Nuova Terra Antica

I
Pasture, Vineyard and Arable Land in the Bible

The Genetic Identity of Living Creatures

Agrarian literature in the East seems to be as ancient as writing itself: in the Bronze Age – three millennia before the beginning of the Christian Era – Mesopotamian cuneiform tablets and chronicles written in Egyptian hieroglyphics record the size of harvests, lay down regulations for the use of water and the distribution of fields, and outline the respective positions of the various social classes who are to enjoy the fruits of the earth. Though these early texts from the valleys of the Nile, the Tigris and the Euphrates lie outside the scope of a history of the agrarian literature in the West, one text of Eastern origin does provide the very first chapter of that history: the *Bible*, a text written by a people who settled on the Eastern shores of the Mediterranean and formed a nation whose links with the West would be long-lasting and profound.

«A river had its source in Eden which irrigated the entire garden and then divided into four parts… The third was named Tigris and flowed east of Assyria. The fourth river was the Euphrates». Genesis places the origin of man in Mesopotamia. This small silver statue comes from the plains in between the two rivers and represents a crouched bull, a divine emblem and symbol of strength and fertility. The small dimensions (4.9 cm long, 2.8 high) and the presence of a small hole above the front legs would make one think that the statue, from the 3rd millennium BC, may have been used as a pendant or ornament.

If agriculture began in the East, it was in the West that it would develop over the course of the centuries, with inputs from all the various continents ultimately giving rise to a technology based upon scientific knowledge. Its pages often illustrating methods whereby mankind could control the natural phenomena that supply him with food, the *Bible* provides a point of contact between these two worlds, and is thus a fit starting-point for a study of agrarian literature in the West.

The Jews were a people of shepherds and farmers, and their holy books are so full of references to agricultural work that they form a veritable encyclopaedia of agrarian practice between the dawn of the Bronze Age and the Iron Age – an encyclopaedia that has been carefully analysed by both historians and anthropologists. Restricting itself to the history of agrarian knowledge and know-how, which is clearly different to a history of agriculture itself, the discussion here will focus solely on the pages of relevance to an understanding of agronomy rather than agrarian practice as a whole – that is, it will cover material which not only bears witness to the state of agriculture in this protohistorical era but also reveals how the learned figures of the time reflected upon matters agricultural.

The first passage in the *Bible* that is of significance to a historical examination of notions relating to the cultivation of crops and the raising of animals comes in the account of the Creation which opens the *Book of Genesis*. On the third day, the Creator, having separated land and water, said:

«*Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after its kind, whose seed is in itself, upon the earth, and it was so. And the earth brought forth grass, and herb yielding seed after its kind, and the tree yielding fruit, whose seed was itself, after his kind*.» (1.11-12)

Then, over the next few days, the Creator would order that the creatures of the waters were created in *species suas*, the birds of the air *secundum genus suum* and the animals of the

earth *secundum species suas* – three expressions that each reflect the clear and unequivocal concept that is mentioned with regard to plants. That the herbs and the trees should each *«yield seed after his kind»*, and that each seed *«is in itself, after his kind»* might appear straightforward to us, but it was far from being so to the Ancients. The biological notions of the Greeks, for example, were based on the idea of the chance generation of all lower beings, from plants to insects: a notion of biological generation which would for almost two millennia form an insurmountable obstacle to progress in knowledge of the natural world. In so clearly laying down that, throughout the natural world, parents and offspring correspond to an identifiable model, the *Bible* anticipates a concept that is essential to modern natural sciences: the idea that, in the act of reproduction, parents transmit to offspring a heritage which is the exact repetition of that from which they themselves originated.

The Cursing of the Land

No history of mankind's millenary struggle to guarantee provisions of food can fail to mention the Biblical passage regarding the cultivation of the land, with the curse that God utters when driving a disobedient Adam and Eve from the Paradise which had been intended as their home:

«Because thou hast harkened unto the voice of thy wife, and hast eaten of the tree, of which I commanded thee saying, Thou shalt not eat of it: cursed is the ground for thy sake; in sorrow shalt thou eat of it all the days of thy life. Thorns also and thistles shall it bring forth to thee, and thou shalt eat the herb of the field; In the sweat of thy face shalt thou eat bread, till thou return unto the ground; for out of it wast thou taken.» (3.17-19)

These are lines that have a certain resonance for anyone who has studied the history of human society and its age-old struggle to control the forces of Nature which threaten the fruits of human labour and can result in starvation and death. Where it is not watered with the sweat of man's brow, the earth by itself brings forth nothing but thorns and thistles; and even where it has been rendered fecund through the expense of sweat, the golden crops are at risk from flood, hailstone and microscopic fungi. This biblical account of a curse upon the land seems to capture the essence of mankind's relationship with natural resources; it stirs a deep realisation that the entire history of the development of agronomical knowledge over the centuries is predicated upon mankind's striving to make access to food less physically demanding and less subject to the whims of chance. History reveals the effectiveness of man's efforts towards this goal, but also that each success is continually being frustrated: as soon as it would appear that mankind has come up with the means to render crops abundant, the population of the planet itself grows, thus increasing the uncertainty of food supplies. This is the fate which, in little under a century, Western society believes itself to have defeated, its scientific knowledge generating a body of agrarian technology that is the most efficient the world has ever seen and has resulted in a previously unknown level of guaranteed food supplies.

Starting from the 18th dynasty, a kind of guide started to be placed inside tombs to assist the deceased in their after-life. The texts were one of the most important expressions of Ancient Egypt's literary culture. This papyrus, of the period between 1070 and 712 BC, shows a detail of the *Book of Deaths* of Nebhepet, a scribe supervising the works in the Teban Necropolis, with two men employed in scything wheat, and a third leading a plough pulled by two oxen. The plough may be defined as a *one-piece plough* of the White classification.

But has Western society really shaken off the divine curse? It certainly believes itself to have done so, sloughing off the age-old fear of hunger. But now, at the threshold of the third millennium, food has re-established its ancient links with energy resources, following increases in price of the latter as demand has outstripped supply. With the extraordinary economic growth of Asia, the new millennium has seen an inevitable growth in new demand for food. And this demand from peoples who do not have sufficient land to support a diet that is based on foodstuffs other than rice has created a new tension in the distribution of food resources, which are no longer enough for world markets to satisfy the food requirements of the West alone (one tenth of the world's population) and meet those of the rest of the world with aid supplied solely from surpluses which are no longer available. Will technology come up with the means of overcoming this shortfall? There is no way of forecasting how long the Earth can, in violation of the biblical curse, go on producing all the food that people would like; how long it can go on yielding up the energy resources demanded by the culture of consumption which now predominates worldwide.

Jacob and Sheep Breeding

The third passage for examination comes from the second chapter of *Genesis*, which describes Paradise (a word which we know to be a synonym of "garden"):

«And the Lord God made […] every plant of the field before it was in the earth, and every herb of the field before it grew; for the Lord God had not caused it to rain upon the earth, and

Bread and beer were the staple food of the population as well as funeral offerings for the dead: small wooden models were placed in the tombs of servants representing the process of bread-making, which was essential also for the production of beer, obtained from the fermentation of barley loaves. This model, from the period 2190-1976 BC, comes from the Necropolis north of Gebelein. It shows four servants: one is looking after the oven, one is mixing dough, the third is shaping the dough into loaves, and the last one is carrying a tray.

The Gifts of the Promised Land

On Mount Sinai, Yahweh would not only hand down moral precepts but also rigorous norms that the chosen people were to follow in exploiting the land He had promised them. Chapter 25 of *Leviticus* tells us:

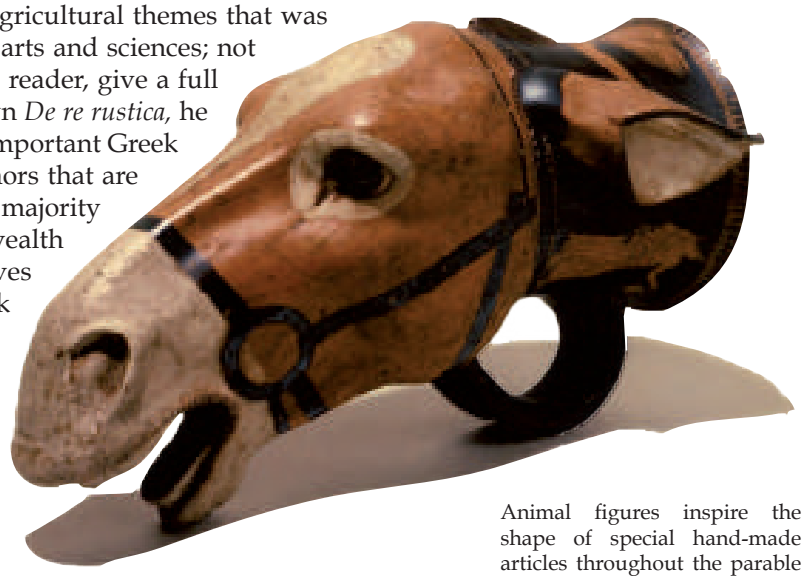
«When ye come into the land which I give you, then shall the land keep a sabbath unto the Lord. Six years thou shalt sow thy field, and six years thou shalt prune thy vineyard, and gather the fruit thereof. But in the seventh year shall be a sabbath of rest unto the land, a sabbath for the Lord, thou shalt neither sow thy field, nor prune thy vineyard. That which groweth of its own accord of thy harvest thou shalt not reap, neither gather the grapes of thy vine undressed; for it is a year of rest unto the land. And the sabbath of the land shall be meat for you, for thee, and for thy servant, and for thy maid, and for thy hired servant, and for thy stranger that sojourneth with thee. And for thy cattle, and for the beast that are in thy land, shall all the increase thereof be meat.» (25.4-7)

The passage raises a number of questions. Is the seventh year rest of the land intended to allow it to lie fallow? Did the Israelite farmers practise the sabbath fallow in the cultivation of individual fields, or did they suspend cultivation of all their land for an entire year? Did the Jews then follow this precept over the centuries? And what consequence did this have on the availability of supplies? These are all questions which are difficult to answer. It might, therefore, be more fruitful to approach things from a different angle, starting with the observation that any modern-day visitor to Palestine who happens to come from a country of flourishing agriculture finds it difficult to believe that this small, arid and rocky region could have been God's gift to his Chosen People. And yet, in the third chapter of *Exodus*, Yahweh promises the Israelites that the land He will give them will be one *«flowing with milk and honey»*, and in demonstrating

III
Agriculture and Athenian Schools of Philosophy

Socrates Discusses Rural Management

Ancient Greece produced a literature on agricultural themes that was as rich and varied as that relating to the other arts and sciences; not only does Marcus Terentius Varro, an attentive reader, give a full fifty names when, in the introduction to his own *De re rustica,* he lists those he considers to have been the most important Greek writers on the subject, but of the fifty-one authors that are listed at the opening of Columella's work, the majority are Greek. However, almost nothing of this wealth of texts has come down to us: all that survives of Hellenic Georgic literature is a short work by Xenophon, two brief botanical treatises by Theophrastus and fragments from Classical authors collected in the Byzantine *Geoponica*.



Animal figures inspire the shape of special hand-made articles throughout the parable of Greek plastic art. This *rhyton* representing the head of an ass dates back to 5th century BC and is attributed to Brygos the painter.

An Athenian nobleman, Xenophon – like Plato and Aristotle – marks the continuing vitality of the teachings of Socrates. A versatile author, he would write works of history, moral science and philosophy. However, though these are distinguished by great ingenuity and elegance, they would not enjoy the high esteem of the work of his two contemporaries, who in centuries to come would be seen as expressing the very spirit of Greek philosophy.

On the subject of agriculture Xenophon produced the short work *Economicus*, which is written in the form of a dialogue. The mode of exposition is the same as that one finds in Plato's dialogues: Socrates meets a follower, Critobulos, who asks for advice on the best ways of managing his property. In response to this question, it is Socrates himself who starts to ask questions, leading his interlocutor through an examination of his own experience towards the establishment of the main principles of *domestic management* (*oiconomia*, in Greek). As question and answer followed one from another, Socrates lists the truths that have emerged from the discussion, thus defining a frame of reference for the on-going exploratory dialogue. Having established the sphere, aims and means of *oiconomia*, Socrates tells Critobulos of his own encounter with Iscomachus, a young man whom he says he admires for his beauty and virtue and who is well-known in the city for the skill with which he administers the family property. In recounting this meeting, Socrates reports a dialogue within the dialogue, covering the administration of a farming concern and the various techniques employed in the fundamental procedures of crop cultivation.

The military expansion and economical development influences Roman agricultural production towards major specialisation: the wine and oil producing farms of the Sabine hills give way to large wine and oil producing estates of Campania and Apulia. This model of farm building found at Boscoreale is an example of a large wine-producing villa in south Italy at the end of the Republican era.

The Twelve Books

After having cited the major Greek and Latin writers on agronomy – from Hesiod up to his own contemporaries such as Cornelius Celsus, Julius Atticus and Julius Graecinus – Columella's first book lists the basic criteria to apply when deciding to buy rural land. The writer teaches the reader to evaluate the fertility of the land and the salubrious qualities of the air and water, then moves on to give the necessary characteristics of the farm buildings in relation to the size of the estate and the crop requirements.

In discussing these matters, Columella focuses directly upon the economic aspects of agriculture. It is this economic awareness which constitutes one of the particular characteristics of *De Re Rustica*, a work which eloquently reflects the extraordinary prosperity generated by the intense mercantile, agricultural and manufacturing activity that marked the high point of the Roman Empire. Indeed, as early as opening to his first chapter, Columella makes explicit reference to the role of economic factors in agriculture:

«Anyone who wishes to dedicate himself to agriculture should know that three things are equally fundamental: knowledge of the subject, willingness to invest, desire to work.»

Along with knowledge and industry, financial resources are a *sine qua non* for success in agriculture. Having stated this basic requirement, Columella then goes on to analyse the various economic aspects of an agricultural enterprise: fixed investments (land, house, stables) and investment concerns in chattels (slaves, livestock, supplies). Comprehensive and carefully-articulated, this analysis established a paradigm that for 1,500 years would survive in the examination of rural which figured in the opening section of treatises written by agronomical writers in the West. Equalled but never superseded, this framework would long remain the basis for rational evaluation of the various aspects of farming business – right up to the time when economics would generate new disciplines that brought accountancy to bear in an analysis of agricultural activities.

The second book opens with a classification of different soil types. This is followed by an examination of the different ways of working the soil and various practices for the application of fertilizer; thereafter come techniques for the planting and cultivation of cereals, legumes and meadows, followed by descriptions of harvesting and haymaking.

A series of wine amphorae produced in the workshops of the western coast of central Italy between the beginning of the 2nd century BC and the 1st century AD (78 cm high, 14 cm the diameter of the mouth). The first one, in yellowish- reddish terracotta, is classified as transitional Greek-Italic type; its capacity is greater than earlier models, thus allowing for increased quantities of the wine to be transported. This type was gradually substituted by amphorae similar to the second model: a reddish-brown terracotta Dressel 1 B, 97 cm high. This type is the most common in the late Republican period, but from the 2nd half of the 1st century BC it began to be replaced by the Dressel 2-4, a further technological progress. The third amphora in pink terracotta (102 cm high) is lighter, its pointed shape allows it to be stowed in ships which transport wine, oil and other foodstuffs. The last one, of a very different colour and shape, was also found in Pompei, (1st century AD, 70 cm high) was made in Crete as can be seen from the inscription in Greek letters which refers to *Lytium*, a wine from Crete.

The Selection of Land and Vines

«So much for the cultivation of fields, as the greatest of poets would say […] Now we come to the cultivation of trees and shrubs, which is perhaps the most extensive part of agriculture […]

A small seedling can develop into a large tree, like an olive tree, or into a shrub, such as the wild palm, or into an intermediate plant that is neither a tree nor a shrub, such as the vine. This latter species is the one that we should discuss first of all, not only because of the sweetness of its fruit but above all because of the readiness with which it responds to human nurture – in all geographical regions and climates (except in lands of excessive cold or heat) […]»

In opening his third book, Columella explains immediately why he is following his discussion of cereals and legumes with that of vines, before passing on to an examination of other arboricultural crops and the raising of livestock. He then moves on (Book III, chap. 1) to examine the two preliminary matters that decide the success of any vineyard: the choice of location and of the variety of vine.

«If one wanted to choose the ideal terrain and climate for vineyards, the most suitable sort of soil – as Celsus correctly points out – is one that is neither too firmly packed nor too loose, though definitely closer to being loose than to being hard. It should be neither too thin nor too rich, though definitely closer to being rich; neither flat nor too sloping, though definitely with some gradient; neither dry nor marshy, though moderately humid […]»

The first lines of Columella's account recognise that vines adapt effectively to various environmental conditions, but also that they do not yield of their best in all sorts of terrain. The finest wines are produced from vines cultivated on terrain with particular characteristics – characteristics which Columella transcribes from Celsus and which are still recognisable as those typical of high-quality vineyards.

Having laid out the criteria to be applied in choosing terrain, Columella then turns to the things that the farmer should pay attention to when selecting his vines:

Bats as a remedy against locusts, fox bile as a treatment for chickens.

From his ventures into the fanciful realms of mythology and astrology, the Byzantine compiler of *The Geoponica* is inexorably led into superstition, dedicating innumerable pages to an age-old tradition of rural witchcraft and the illustration of what are magical procedures pure and simple. As we have seen, Cato collected his own series of magical formulae and rituals, and Varro made his own contribution to rural witchcraft. For his part, Columella had restricted such notions to the confines of the religious calendar, but then Palladius would raise it again to be a key component of agronomical knowledge. Continuing that trend, *The Geoponica* would become the channel whereby the rural magic of the ancient world flowed into the agronomical science of both East and West, becoming a subject of careful study for medieval writers in the Christian and Muslim worlds. In effect, the power of this tradition would prove to be so compelling that, even beyond the dawn of the Early Modern period, one finds the less original writers on matters rural and agronomical still paying it a certain tribute of respect.

As an example of the witchcraft contained within the precepts presented in the Byzantine text, one might mention chapter one of Book Thirteen, where the farmer is

The rulers of León, one of the principalities that, being situated amongst mountain ranges and plateaux in northern Spain, managed to avoid Moslem occupation, were buried in the basilica dedicated to Isidore of Seville. Frescoed in the middle of the 12th century with key events of the life of Jesus Christ and a large calendar, the royal chapel is called *"the Sistine Chapel of Romanesque painting"*. The unknown artist produced an elaborate and suggestive work similar to the numerous Italian and French Romanesque sculptural calendars. If the figures of the first semester are somewhat different from traditional ones, those of the second reflect the Italian masterpieces of Parma and Ferrara, that show the sequence of mowing, threshing, harvesting, the last fattening and slaying of the pig. Less easy to understand is the figure for December, that seems to be breaking a piece of bread by the fireside.

XVI
Viticulture, Veterinary Science and Falconry in the Po Valley of the Fourteenth Century

Cereals and Legumes

Having spelt out the general rules for crop cultivation and farming, in Book Three Crescenzi gives details concerning basic herbaceous crops: cereals such as wheat, barley, millet and foxtail millet, or grain legumes such as peas, vetch, broad beans and other minor species. It is not without interest that alongside wheat he still mentions spelt and emmer, two cereals which in the Middle Ages had largely been preferred to summer wheat because more resistant to certain adverse conditions. However, in the chapters he dedicates to these two species, De Crescenzi does not provide us with any information regarding where and how they are cultivated, thus depriving us of a precious contribution to an understanding of the history of the two crops.

The chapters on crop cultivation are one of the sections of the *Liber Commodorum* in which the main focus is clearly on traditional practices rather theoretical/didactic discussion, hence these pages contain certain interesting details with regard to the arable farming techniques of the day. The account De Crescenzi gives of the cultivation of chickpeas is just one example of this focus on practical precepts. Again quoting from the Bolognese edition of the work:

Threshing by flails in the illustration dedicated to July of the calendar which introduces the *Offitium Mariae Virginis* hand-written in 1385 by Friar Bartolomeo de' Bartoli, poet and calligrapher, Abbot of the Convent of Santa Croce in Ferrara. The codex contains various series of illuminations made in successive later periods. That of the calendar have been attributed alternatively to Andrea de' Bartoli, brother of Bartolomeo, and to Tommaso of Modena, one of the greatest painters of the Po region in the second half of the 14th century. The use of flails illustrated in the illumination testifies that the instrument was used in the region, as an alternative to threshing by treading with animals, thus becoming the main means of threshing in small farms without draught animals.

A milking scene in an illustration of the month of April in Bachiacca's tapestries. In outlining the framework of transhumance milk-farming in the Po Valley in the middle of the 16th century, the *Giornate* offer agronomical science's first reflection on the evolution of cattle breeding from mere traction force reproduction to an apparatus of transforming forage produce into protein foodstuffs.

of the weaned animals not covering the cheese revenue lost due to their consumption of milk. Hence, a Lombard *malghese* would send both male and female calves off to be slaughtered when they were just 25-30 days old – even though, as Scaltrito himself recognised:

«Their meat is more tender when they have been well weaned on milk for fifty or sixty [days] […] *But this can be done only when cheese fetches a lower price.»*

To replenish his herds, the Lombard malghese would purchase cows, already carrying their second calf (that is, around four years old), at markets in Switzerland and Valtellina, mountainous regions where the cheese industry was not so highly developed and the main product of zootechny was still the livestock itself. Raised in healthy mountain pastures, the heifers had the strength, fertility and longevity needed for a working-life that not only combined tiring annual ascents to mountain pastures and long periods in plain-land stables

Haymaking in one of the paintings that Pieter Brueghel dedicated to the months of the year in 1565, composing a mosaic that reveals the liveliness of the perceptions which the Master experienced in his long itinerary, between 1560 and 1564, from the Alps to the Strait of Messina. Brueghel's imagination - for one coming from the Netherlands - is fired with incredible scenarios and his fantasy is carried away, as in a fantastic dream, to compose rocky ridges, precipices, rumbling torrents typical of an Alpine or highlands of Calabria scene, together with familiar scenery of his own country: peasants dressed like those of Zeeland or Overijssel carry on typical Flemish carts towards homes with the traditional steep roofs of Dutch houses the normal harvest reaped in lands on the shores of the North Sea. While a farmer in a white shirt, clothing unknown in the Italian

From the principles to be followed in selecting seed, De Serres passes on to an examination of the various species of cultivated cereal crops, illustrating the biological and botanical characteristics of each, listing the most common strains and indicating their agronomical requirements (time for sowing and weeding as well as methods of harvesting). In order of presentation, the species he discusses are: wheat, rye, barley, millet, oats and rice, the latter being the most recent addition to French cereal crops. A special paragraph is also dedicated to dredge, a mix of wheat and rye which throughout the entire Middle Ages had been more widespread than dedicated wheat crops because the range of resistance that this mix offered to a variety of conditions and circumstances lowered the risk of an insufficient end crop.

Of particular interest is the space that De Serres dedicates to the problem of cataloguing the various species of wheat, a theme that we have seen exercised by various of his predecessors: Pliny the Elder, who devoted most space to the matter; Agostino Gallo, who gave the issue a certain amount of consideration; and Konrad Heresbach, whose discussion is mainly based on bibliographical references rather than direct agronomical observations of his own. Unlike the German, De Serres was a genuine agronomist rather than a erudite scholar; furthermore, he was familiar with agriculture as practised in various regions of Europe. This means that when he attempts the same sort of classification as that offered by Heresbach, he does so with much more precision and completeness.

Still, even he makes errors, some of them serious. The first of these concerns the identification of *rousset*, an aristate red wheat that was common in France, with the emmer mentioned in Classical texts. Having cited Columella's classification, which

The days of the great slaughter in the illustration dedicated to December in the calendar of Pietro Stefani and Egidius Sadeler. Based on the production of cereal for human consumption, up to the revolution of crop rotations European agriculture was not able to produce the necessary forage to feed large winter herds: when they returned at the end of autumn all the animals that had not been chosen for reproduction the following year were slaughtered. Olivier de Serres dictates precise, functional rules regarding the order that the slaughters should follow for each and every part of all species of animals.

The refinement of French gastronomy is further illustrated in the following chapter, dedicated to the fruit and vegetable conserves, a long catalogue of elaborate preparations divided on the basis of the substance used as a preservative: salt, wine must, cooked wine or honey. In a curious insight to the customs of the day, we learn that the making of such conserves is a task entrusted to the daughter of the *mesnager*, who:

«will derive great honour and pleasure from the fact that, should relatives or friends arrive unexpectedly, she can adorn her table with various conserves and preserves produced at the opportune season, of a goodness and refinement in no way inferior to those which are made in great cities […]»

The Pharmacopoeia of Rural Life

The third chapter of the last book is dedicated to various themes relating to the household economy. The first of these concerns the materials that can provide lighting: tallow, oil and wax, the latter the source of a more pleasant light and thus reserved for evening reading within the *manoir* and such occasions as banquets and the entertainment

«In truth, I have not spoken of the plough as a working instrument, because I do not respect it overmuch, and indeed I consider this tool to be a poor thing, and one which has retarded the progress of agriculture amongst us. When I show you the instruments, I shall also show you the plough, and shall show you, considering its construction carefully, the reason why it was made. You already know it well; it suffices that I tell you that because of the shape of its ploughshare and its being equipped with two middling mouldboards, it is immediately obvious that such instruments are made only for cutting furrows, or drains […] to open the land so as to divide it in two […]» With these lucid physical-mechanical statements, Cosimo Ridolfi dictates, during the fourteenth session of his *Lezioni empolesi*, on 30 August 1857, the funeral oration on the history of a tool to work the soil: the plough, that in the language of rural Tuscany is a symmetrical tool with two mouldboards on which the greater part of ploughing is conducted in the farms on the opposite slopes of the Apennines, that is the countryside around Florence and Bologna. Its use over such a large territory is quite abnormal according to the geography of ploughing instruments throughout Europe: an anomaly, as Ridolfi explains, that consists in the impossibility of describing it as an authentic plough, since it should be classified, because of its symmetry, as a "furrower", that is an instrument that traces furrows, and one with which it is not possible to really plough.

The author does not say what either is used for, but it is clear that while the former might be used to form both *quaderni* and *vaneggie*, the second – which at each passage digs only a single furrow and raises two turned strips, could only be used to form *quaderni* (Tanara recognises that it leaves the soil below the crest of the ridge undisturbed).

In describing the preparations for the planting of a hemp field, the author mentions two ploughings, the second preceded by the spreading of manure, and one session of spadework to dig in the broad bean crop sown at the second ploughing. He points out that both these ploughings form *quaderni*. It must be assumed therefore that the *vannegie* themselves were formed through spadework; however the uncertainty in the wording of the text means one cannot establish if the soil was dug to the double depth (the former by the plough, the latter by the spade) which Tanara himself suggests for the planting of trees, and which Bolognese hemp farmers in the following century would adopt as standard practice.

At the same time as working the soil, the farmer also follows a complex process of applying manure and fertiliser, the order adopted in this process being the result of a consolidated tradition. The first manure applied was ox or sheep dung, to be dug in with bean or vetch seed; towards the beginning of winter, these latter plants would be flourishing, ready to be dug in again in order to enrich the soil with nitrogen compounds.

Abstract