Farm like a Roman: Livestock in Ancient Italy

by

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For my parents

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Introduction

This work is a synthesis of the major Roman agricultural writers: Cato, Varro, Vergil, Columella, Pliny, and Palladius. While archaeological evidence and artistic representation are not ignored, the bulk of the information in this text comes from ancient literature. In that sense, this work could very well be considered a guide to what six ancient writers thought farming should be, just as much or more as it can be considered historical description of the variety of Roman farm practices. In other words, the question of to what extent the practices advocated by our sources were actually implemented—how much the common farmer was heeding the advice of prominent writers—is not the primary concern. Rather, this work aims to synthesize, consolidate, and illuminate these writers’ advice, both in comparison with and in contrast to each other and to modern authorities. Of course, these select writers had sources of their own. Over fifty Greek authors wrote on agriculture, many of whom were sources—cited or uncited—for the Romans. The text of Mago the Carthaginian was another crucial source for Roman writers, translated into Latin from Punic by decree of the senate in 146BC. KD White proposed that there may in fact be no historical Mago, but rather the text represents centuries of accumulated farming experience.\(^1\)

Marcus Porcius Cato (234-149BC), known as Cato the Elder of Tusculum, gives us our earliest extant Latin source on farming. He grew up on his father’s farm and later in life owned large estates worked by slave labor. He had a distinguished military career, serving in the Second Punic War and later commanding armies in Spain. As a statesman, he was known for simplicity, patriotism, and opposition to
Greek culture and luxury. He held the offices of questor, aedile, praetor, consul, and censor in due succession. In the years preceding the Third Punic War, he was furthermore known for ending every speech in the senate with *delenda est Cathago*, “Carthage must be destroyed,” regardless of the occasion. He is not only the first Roman agriculture writer, but is the first Latin prose author of any substance. His collection of farming precepts, which emphasizes olive groves, vineyards, and cattle, is his only complete surviving work. However, we should recognize that Cato represents an emerging type of estate farming, and varied and traditional practices coexisted with the type of farm he portrays in his work.

Marcus Terentius Varro of Reate (116-27BC) published *De Re Rustica* in 37BC, one of seventy-four works attributed to him. He wrote for his younger wife Fundania, who had recently bought an estate. Varro was a prominent historian, philologist, agriculturist, and poet, who held several offices under the Pompeian party and was charged by Julius Caesar to supervise an intended national library. He also served in the military, commanding a section of Pompey’s forces. His farm writings are in dialogue form, with different characters conversing about the various animals and crops. Varro owned large farms in which some of his greatest interests were the developing luxury markets, and he went into some detail about specialty items such as thrushes and salt-water fish ponds. He is not shy about listing his sources and often gives explanations for the existence of sacrifices, rituals, and other farming practices.²

Publius Vergilius Maro (70-19BC), born near Mantua in northern Italy, is one of the most famous poets of the ancient world. His agricultural poem, *Georgics*, was written after meeting his patron Maecenas, but before his masterpiece the *Aeneid*.
Written in 29BC, the poem is usually not considered by scholars in the same category as those by the other sources of this work, more so of literary than agricultural merit. However, his ancient successors do cite him as an authority and it is clear that his work was influential not only poetically but practically. His chapter on bees was especially influential. While he may have had less management experience and investment than the other sources, he offers a perspective less tied to the large slave-worked estates of Varro and Columella, one more geared toward small landowners.³

Lucius Iunius Moderatus Columella (c. 4BC-65AD) was born in southwestern Spain but moved to Italy where he owned farms near Rome. The twelve books of his *Res Rustica* are the most comprehensive surviving farming manual of the ancient world. After a period of military service, he seems to have spent most of his time farming in Italy, making him more of a full-time farmer than any of his literary predecessors. His work is aimed at owners of large estates, though he values tradition and is often impatient of frivolities. He cites Vergil over fifty times, as well as Aristotle, Cicero, Demosthenes, and Xenophon, though much of his knowledge is clearly from his own experience.⁴

Gaius Secundus Plinius (23-79AD) wrote a vast encyclopedia, *Historia Naturalis*, in which animals are one of many topics. A learned man, Pliny spent his life gathering information. He was constantly read to by his slaves and recorded any precepts of note seemingly without regard to their probability. Many of the more preposterous pieces of advice in the present work, especially in veterinary medicine, come from Pliny. However, since his writings draw on such a breadth of sources and traditions, Pliny plays an important role in expanding our knowledge of Roman
practices beyond those advocated by the other authors, who are in many respects like-minded. Pliny is furthermore one of the best sources for biological knowledge during his time, though some of his more interesting statements—such as giving life spans for farm animals more or less commensurate to those expected today—are called into question by his other outlandish advice.⁵

Rutilius Taurus Aemilianus Palladius owned farms on Sardinia and near Rome. The dates of his life are not precisely known, though he is thought to have published his work *Opus Agriculturae* in the late ⁴ᵗʰ century AD. His name indicates that he comes from a prominent family, though his work is organized, simple, and earthy. While he is often thought more or less just to have repeated Columella’s work while organizing by month rather than by topic, it is clear that Palladius had a wealth of farm experience himself. There are significant instances where he adds something not mentioned in the other Roman sources, and what he omits from his sources is also telling. Palladius’s work is accessible and does not correspond to any one type of farm such as a large estate, but rather would have been useful to a range of farmers. Unlike some of his predecessors, Palladius does not often list the source of his advice.⁶

It should also be mentioned that *Roman Farming* (1970) by KD White is the most prominent English language secondary literature on the topic. White gives a comprehensive overview of practices and motivations of Roman farmers, though he devotes only sixty of over five hundred pages to animals. Whereas White’s work reads more like a history, the present is intended to be more like a manual, enumerating specifics like daily rations of food. Other sources include J.M.C.
Toynbee’s *Animals in Roman Life and Art*, which provides much of the mythological and cultural information, as well as numerous modern authorities on each of the animals.

Each chapter is divided into subheadings: an introduction to the animal, housing, feed, breeding, health and manure. Any additional topics—such as draft power for oxen and cheesemaking for goats—come before the manure heading. These sections correspond roughly to Varro’s organization of his chapters on animals. Furthermore, the chapters are arranged in more or less the same order that they are in Varro and Columella.

While the Roman sources wrote extensively both on crops and livestock, this work only focuses on the latter. The Romans in a sense thought of these pursuits as separate: an estate had both a *vilicus*, overseer of crops, and a *magister pecoris*, master of the flock. Columella states: “the aim of the farmer is contrary to that of the shepherd, since the former delights in land which is plowed and naked, the latter fallow and grassy.” However, crops and animals were also recognized to be complimentary, and the ideal farm fed its stock from its own crops, in turn fertilizing from its own manure and plowing with draft power.\(^7\)

Just as modern people do, Romans held varied attitudes and preferences toward different species of farm animals. Not all animals were treated with equal consideration, and not all farmers had the same attitudes toward each animal. However, some themes do stand out in the literature as particularly emblematic of Roman farming:
1. **Late Breeding, Weaning, and Castration**: with the exception of horses, Roman farm animals were bred at later ages than their modern descendants. Furthermore, some animals which are often bred annually today were given ‘fallow’ years, meaning it was considered wise to breed every other year. Almost across the board, males were given more feed leading up to breeding season, while it was reduced for females, since this was thought to increase fertility. It was also common practice to take away some or all offspring from young mothers—either to the butcher or a surrogate mother—for the sake of the developing mother’s health or to increase milk per animal. Livestock of both sexes were no longer allowed to breed at ages which are often still considered prime today. Likewise, young animals were typically weaned from their mothers at ages sometimes much later than is recommended today and castration was normally performed relatively late. Many of these methods may have been motivated by a desire to keep animals strong on comparatively meager feed by allowing them to develop fully before mating. Physiological changes in animals and breeds over the last 2,000 years may also play a role.

2. **Substantial Housing**: at least in the type of large estate farming advocated by our sources, farm animals often had access to substantial infrastructure in which they gave birth, nursed, and usually spent the night. Shelters were often divided into sections for each breeding female and were floored with wood. Centralized housing existed even for animals such as cattle and sheep which would have been hardy enough in the Mediterranean climate to spend nights and give birth on pasture, as they often do today. For more mobile ancient
Italian stock raisers, it was the case that their stock was always on pasture. Our sources, however, rooted to a farm but without substantial fencing, may have been motivated by a desire to have easy central access to count and treat animals. Predator protection was likely another major motivating factor, especially for sheep and goats: it was easier for each animal’s overseer to ensure their safety at night when they were in a shelter rather than grouped without fencing outside. Not to mention, the overseer also got to spend the night indoors with the shelter system.

3. **Seasonal Pasture**: for all grazing animals, low lying winter pasture and upland summer pasture were preferred. This is a consequence of the Italian climate.

4. **One Worker, One Species**: typically on the large estate farms, a slave was employed for each major animal the farm raised. This worker had a title based on the animal of his charge—for instance, the swineherd was referred to as the *porculator*—and seems to have spent all his time with them. For large herds, the primary caretaker had workers under him.

5. **Notable Feed**: the most remarkable was acorns, which were the primary feed for pigs and part of the diet for cattle, goats, and ducks. In some instances, they seem to have acted as a replacement for grain in today’s terms. Leaf hay was also common, often replacing grass and legume hay, though it was not highly esteemed. For cattle, goats, and pigs, woodland was just as preferred as open pasture. While some feeding practices may have been motivated in part by frugality, in many instances such as for cattle, sheep, and chickens—sows
being a prominent exception—the daily ration of feed was comparable in poundage to modern recommendations.

6. **Veterinary Practices**: many of the treatments advocated by the Romans make absolutely no sense to the modern reader. Some are clearly painful, cruel, and ineffective. However, many preventative measures may resound with contemporary farmers and some herbal remedies may merit closer look. Some of the most popular components in veterinarian treatments were: leek, garlic, wine, *cytisus*, oil, letting blood, fish sauce, vinegar, frankincense, pitch, litharge of silver, tender tree growth, honey, sulphur, *amurca* (olive oil lees), *consiligo* (lungwort), and urine.

7. **Physical Restraint**: there exist a variety of instances in which it was recommended that animals be physically restrained, some of which are not normally practiced today. For instance, oxen were closely bound to poles as part of training, jacks and mares were put into a breeding ‘machine’, lambs were tied up to discourage frivolity, and goats were sometimes shackled during milking (though this was similar to the modern milking stanchion).

8. **Wild Animals**: the wild cousins of certain farm animals were sometimes caught and bred, including cattle, donkeys, ducks, and bees.

A note on plants: the identity of two plants especially esteemed by the ancient Romans is not unanimously agreed upon today. They are referenced often throughout this work:

- **Cytisus**: this plant was thought by the Romans to be highly beneficial for every major class of farm animal – ruminant, equine, fowl, bees, and swine. In
addition to its nutritive qualities, it was valued as a medicinal ingredient and thought to increase milk production, including in humans. It was esteemed both as a plant in pasture and as dried winter feed. The Lewis & Short Latin dictionary states that the plant is *medicago arborea*, a shrub often confused with the modern classification *cytisus*, which refers to another genus in the legume family. Ash translates as ‘shrub-trefoil’ from Columella, while Rackham and Fairclough leave the word untranslated from Pliny and Vergil respectively.  

- *Medica*: considered one of the best fodder crops for grazing animals, this plant was highly recommended by writers after Cato, who appears not to have known of it (it is said to have been imported from Greece after his death). Like *cytisus*, it is also a legume, though the precise species is not agreed on. Hooper and Ash translate from Varro as ‘alfalfa’, Fairclough from Vergil as ‘Median clover’, Ash from Columella as ‘Medic clover’, Forster and Heffner from Columella as ‘lucerne’ (alfalfa), Rackham from Pliny as ‘lucerne’, and Fitch from Palladius as ‘alfalfa.’ The entry in Lewis & Short states: “an excellent kind of clover introduced from Media; Burgundy-clover, lucern (Medicago sativa).” These translations are of course not compatible since alfalfa, though in the same family, is not a clover. Nevertheless, based on Columella’s description of the plant as a long lasting hay crop, alfalfa seems the most likely case.
Cattle and Oxen

The roots of the ancient Romans’ relationship with cattle, especially working cattle, run deep. It is said that the very word for their land, *Italia*, was a name given to the peninsula by the Greeks from their word for cattle, *itali*, on account of the number and beauty of the animal in the region. Moreover, the Latin word for wealth, *pecunia*, was believed to have derived from the word for cattle, *pecus*, and any linguistic questions aside, Romans felt this to be true. Varro states, *nam omnis pecuniae pecus fundamentum*: cattle are the basis of all wealth. This is especially true of oxen, castrated male working cattle, which were the power source for plowing and cultivation of crops, as well as a critical source of transportation.

The importance of this animal in the Roman world is evident from its earliest history and cultural inheritance: value is reckoned in terms of cattle in Homeric epic, and fines at early Rome were imposed in terms of cattle. Columella states that among the earliest Romans, the ox was so well respected that it was an equally capital crime to kill an ox and a man. Furthermore, the legend goes that an ox and a cow drew the plow which marked the boundaries of the city at the founding of Rome. Cato, the earliest agricultural writer, gives more attention in his text to oxen than any other animal, stating, *nihil est quod magis expedit, quam boves bene curare*: there is nothing more profitable than to take good care of oxen.

Cattle had religious significance as well, which was expressed through several means. The act of plowing, as carried out by oxen, at times took a ritual form: Cato states that when the pear trees bloom in the spring, the farm should have a sacrificial feast before beginning the year’s plowing. Pliny states that the ancients held public
games in celebration of oxen.\textsuperscript{16} Yet, cattle were also sacrificial animals themselves, fattened for public offering.\textsuperscript{17} Still, they were the only working animal which received a holiday: oxen could be yoked on feast days only for hauling firewood and grain, while donkeys and mules had a full work day.\textsuperscript{18}

The most important role for cattle in the Roman world was as draft animals. Depending on the type of soil, scale, and wealth of the farm, an operation could have a single cow or multiple pairs of oxen engaged in work. Working cattle were overseen by the \textit{bubulcus}, ox-driver. Cato advises being somewhat indulgent to the \textit{bubulcus} so he would in turn take good care of the draft stock, which was of utmost importance.\textsuperscript{19}

It has often been thought that beef was not a particularly important source of food for the Romans, with much of it consumed only on sacrificial occasions. The cookbook of Apicius devotes ten lines for beef, while it gives more than three pages to pork.\textsuperscript{20} Yet, more recent archaeological work has called this theory into question: there appears to have been no scarcity of cattle slaughtered at an early age for beef in many locations. Moreover, Diocletian’s price edicts, issued in 301AD, actually set the price of beef at a substantially lower rate than pork, implying that it was not scarce and probably consumed regularly.\textsuperscript{21} Of course, diet could have and most likely did change significantly from the time of Cato to the time of Diocletian and Apicius.

Cow milk is also thought to have been, in most regions of Italy, a product of secondary importance. Varro states that cow milk is less nourishing than that of sheep and goats, and less purgative than that of horses and donkeys. Yet, he also states that cheese from cow’s milk has the most nutritive value, though it is the least digestible.
Recognizing the affect of an animal’s diet on its milk, he recommends that the most nourishing milk comes from dry food, and the most purgative from green fodder. Furthermore, groups of people whose diet relied heavily on cow’s milk, such as the people of Arcadia, are pointed out as if an anomaly. These ‘milk-drinking’ tribes tended to be in more northern or lush regions which had rich enough pasture to support high dairy yields.

**Housing**

Shelter requirements for cattle can be divided into two realms: that for the general herd, and that for the working oxen. The main herd of cattle was believed to be hardier than other grazing animals such as equine, and spent most of their time under the open sky, moving from lower winter pasture to higher summer upland when possible. Sunny maritime locations were considered ideal in the winter, while shady, cool, higher spots were preferred in the summer, where cattle fed on mountainous shrubs and other herbage in lightly wooded areas. Clearly though, such range of climate did not exist at every villa, and each farmer had to adapt to his specific circumstances, grazing cattle on pasture when available, grain field stubble, or forested land. Pastures were sometimes managed through a prescribed burn in late summer, encouraging more tender growth. Renting winter grazing land appears to have been common practice as well. Cato states that such agreements ran from the first of September to pear tree bloom in the spring. In such cases, the owner reserved the right to pasture two yoke of oxen and one gelding. Wherever they grazed, steps were taken to ensure that cattle were kept out of the vineyard such as woven hedges.
There were stables for the general herd however, used during the end of pregnancy for the breeding cows. These were built with ample space to prevent the pregnant animals from bumping into each other and floored with stone or gravel, or sand if necessary, on a slightly southward-sloping piece of ground to facilitate drainage.\(^{29}\) During any period in which the herd was kept in the stables, Columella states, they should be called during the evening at the sound of the horn to be gathered from their woodland grazing. At this time, the man in charge of the flock, the *armentarius*, reviewed the herd and took a head count, leading the cows into their stable *ex militari disciplina*, with military discipline. The bulls, however, were left to wander in this system, brought in only when needed for breeding.\(^{30}\)

Oxen, on the other hand, spent a significant amount of time in their stalls where they consumed most of their feed, since the bulk of their time was spent working rather than grazing, which was recommended for oxen only during the brief winter off-season.\(^{31}\) Cato stresses the importance of good *bubilia*, oxen stalls, with latticed feed racks and ample litter for hoof protection.\(^{32}\) A Roman farm preferably maintained the oxen stalls in a warm southward facing winter location, or even had separate winter and summer structures. As with the structure for the general herd, ideal oxen stalls were spacious and well drained, opening onto a yard with running water in which the oxen could drink and bathe after plowing as well as stones sprinkled with salt.\(^{33}\) It was believed that hand-dug ponds or other areas that collected rain water were preferable to cold streams, which were thought to limit fertility.\(^{34}\) Attention to the temperature of oxen is stressed more than it is for the general herd, and Palladius even suggests having a fireplace nearby.\(^{35}\)
Within the structure, there were tie stalls for the oxen where the feed racks were located. The dimensions for the stalls are given between seven and nine feet wide, and ten to fifteen feet long, presumably for a pair. Straw was the preferred stall bedding, though oak leaves and the husks of legumes were also used.

The structure for oxen also included a corral for medical applications. Columella’s corral was nine feet long with decreasing width, from four feet wide at the back to two and a half at the front, floored with oak boards. Seven foot high posts at each corner supported six railing beams on each side and a yoke at the front of the enclosure for fastening the animal. Ropes were also attached to the poles, tied to each of the legs to stretch them out and hold them in place. Animals would be constrained in this enclosure, we can imagine, for procedures like castration, branding, and administration of medical remedies.

Feed

Feed available for cattle varied widely among the ancient Italians, with each farm needing to take a different approach to nutrition based on the available pasture, forest and crops. It is clear that many farms gave out to cattle what today would be considered severely deficient feed, such as chaff and acorns. One interpretation has been to suggest that many farms, too poor to keep sizable herds of cattle on such diets, kept primarily working oxen, which were themselves quite underfed during the winter months. However, it seems that even among our literary authors, who are relatively well-off, a wide variety of feeds were used that are not considered sufficient today, yet sizable herds were supported: Varro considers one hundred head of cattle a
reasonable number. There are two ways we might interpret this, and the answer is probably somewhere in between: Roman cattle were relatively frail compared to their contemporary counterparts and had serious nutritional deficiencies; the feeds used by the ancient Romans actually did a better job supporting herds of cattle than we might have thought otherwise.

As in housing, the general cattle herd and the oxen were treated differently with respect to feed. The latter was given preferential treatment when supplies were low and more likely to be fed cut fodder and dry foods in their stalls, whereas the former would have grazed whenever possible. However, sufficient pasture was by no means a given, and a luxury during the summer. Roman cattle feed varied by season and falls under several different categories, all of which were used on most villas to varying degrees based on specific climactic and financial circumstances: pasture, hay, sown fodder crops, crop stubble, acorns and gathered mast, and crop byproducts.

As discussed above, the general herd moved from low winter pastures and crop residue to high summer pastures and forest whenever possible, according to the resources available. To address shortage of pasture, the land could be irrigated—it is clear from legal documents that this was fairly common—or sown in alternate years to forage crops. While the Italian climate certainly presents challenges for keeping cattle, it seems that these should not be overstated for villas north of Rome with access to decent pasture, if we are to take the size of the herds mentioned in the literature seriously. While oxen seem to have been stall-fed in the majority of cases, Columella also presents another possible management technique: in regions with
sufficient pasture, a villa could keep two pair of oxen and have them graze and plow on alternate days to save labor on collecting gathered feed.  

Nevertheless, many sources of food were used and the most preferred—as today—were grass and legume hay (when not available as pasture fresh in the field).  

Preparations for hay harvest began the previous fall when bushes, shrubs, and weeds were rooted out. Fields were fertilized with manure in February with the moon waxing and cleared of stones and other objects which might get in the way of mowing, then left devoid of human or farm animal footprints until the first cutting in late spring. Hay was cut when its growth was slowed on account of decreasing rainfall but before it became dry. Cut with the human-powered *falx*, which usually means sickle though can refer to a scythe, the hay was left to dry in the field for a period and then turned with a fork to ted it. If there was rain during this period, Columella wisely recommends leaving the hay in the field a bit, and then once again turning it, rather than bringing it in wet. Once sufficiently dry to keep safely without threat of rot or fire, but before it was overly dry, hay was made into bundles and brought into the villa under cover when possible or in cocks. Varro notes that having hay under cover is clearly preferable, as cattle routinely choose it over hay kept in cocks when given the choice. Cato and Varro both refer to *sicilimenta de prato* (literally, that which is cut with a sickle from the field), apparently suggesting that after the first cut of hay, laborers went back over the field with sickles to gather up anything that had been passed over. Varro furthermore recommends, somewhat enigmatically, that this second passing should leave the field *tuberosum*, full of humps.
This practice should not be confused with the second cutting of hay, which was possible in irrigated fields during late summer. Irrigation took place directly after the first cutting of hay. As today, hayfields were managed both by applying fertilizers—animal manure and wood ashes—to perennial pastures, and by plowing up ground and planting seed. Columella recommends restoring neglected pasture by scraping off any moss, uprooting any shrubs or other undesirable plants, and broadcasting seed from the hayloft before applying manure and ashes. Hay seed could also be mixed in the routine February applications of manure as an annual upkeep measure. For plowed land intended for pasture and hayfield, he recommends keeping animals off completely the first year, allowing small stock the second year, and putting cattle on the third year. Despite Cato’s suggestion not to cut hay too late (before seed ripens), it is clear from Columella’s recommendations of reseeding from the hayloft that Cato’s advice was not always heeded well. It is of course possible that Columella kept two stacks: one of ideal hay fed out during spring plowing—as Cato recommends—and another of hay cut past its prime, from which he gathered seed for rejuvenating pasture.

Leaf hay was also common: Cato recommends planting elms and poplars around the border of the farm in order to cut some leaves green as fodder for cattle and sheep. Ash, ilex, ivy, oak, bay and fig leaves were also fed. Columella also suggests leaf hay as a feed, but with less implication of necessity. He notes that it should be fed free-choice, that is, in unlimited quantities. It seems—especially judging from Varro’s silence on the matter—that even by the first century BC the
introduction of new fodder varieties had made leaf hay less necessary on many farms.\(^5\)

Sown fodder crops are stressed as a necessary means to feed cattle. These could have been planted in dedicated fields, in rotation with grain and other crops intended for human consumption, or in between the rows of an olive grove. Clover was cut from bean crops.\(^5\) These fodder plantings were regarded with such importance that Cato recommends devoting half of the villa’s manure to fertilizing them (albeit, in the olive grove, which also received benefits from this application).\(^5\)

Crops recommended included:

<table>
<thead>
<tr>
<th>Cato</th>
<th>Varro</th>
<th>Columella</th>
</tr>
</thead>
<tbody>
<tr>
<td>turnips, lupines, clover,</td>
<td>clover, mixed fodder (barley, vetch, legumes), vetch</td>
<td>lupines, <em>medica</em>, vetch, barley, oats,</td>
</tr>
<tr>
<td>vetch, fenugreek, beans,</td>
<td>[cut in this order before hay]; lupines, <em>medica</em>,</td>
<td>fenugreek, bitter vetch, chickpea, <em>cysis</em>(^6)</td>
</tr>
<tr>
<td>bitter vetch, panicgrass</td>
<td><em>cysis</em>(^5)</td>
<td></td>
</tr>
</tbody>
</table>

These were fed according to season, cut before maturity (going to seed) and stall-fed fresh in the case of oxen. Some crops, such as oats, could also be grazed by the general herd or cut as stored hay.\(^5\) *Medica* is recommended by Columella as an outstanding feed which produces four harvests in each of ten years after one sowing, improves soil, makes lean cattle fat, and has medicinal value.\(^5\) This plant (possibly alfalfa) appears to have been introduced after Cato’s time and may help explain the size increase noted by archaeologists in cattle, especially from the republic to the imperial period.\(^5\) *Cysis* is also highly recommended, as it was for most farm animals.\(^6\)
Acorns and other tree mast were used as cattle feed as well. They were gathered after the year’s sowing was over and soaked in water.\footnote{61} They seem to have been fed as a supplement to other foods such as grass and leaf hay.\footnote{62} Grain was consumed in a variety of forms: green in the field, in seed form, as stubble, and as chaff.\footnote{63} Chaff was recognized to be undesirable, though it was considered common: millet, barley, and wheat chaff were used in that order of preference.\footnote{64} Grain was consumed in the field to thin it when a sowing was thicker than desired. Pliny also suggests that bean stalks will regrow after a grazing if it occurs during a waxing moon.\footnote{65} Grape skins were also common feed, though Columella recommends giving a wet mash instead to inspire “good cheer” if there is a shortage of legumes.\footnote{66} As a last resort, straw was sprinkled with salt.\footnote{67} The type and amount of feed varied widely with the seasons and tasks required of oxen. Cato’s volume and poundage recommendations are difficult to follow. By my interpretation he seems to suggest for oxen between eleven and eighteen pounds of hay per animal daily as well as either eighteen cups of soaked acorns, thirty-six cups of grape husks or soaked lupine, plus the seasonal fodder crop depending on how hard they are working. He reckons a year’s ration for a pair of oxen at a cubic meter of lupines, two cubic meters of acorns, 377 pounds of hay, 264 pounds of beans, a quarter of a cubic meter of vetch, and clover in an amount lost through textual corruption. The yearly amount of hay does not match his daily allowance, which must have varied considerably by season.\footnote{68}
Columella gives recommendations based on month.\textsuperscript{69} Roman units have been converted to the modern.

<table>
<thead>
<tr>
<th>January (not working)</th>
<th>March and April</th>
<th>Mid-April through June</th>
<th>July through October</th>
<th>November and December (sowing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 cups soaked and mashed bitter vetch mixed with chaff OR 37 cups soaked lupines OR 18 cups <em>cicerula</em>, chickpea, plus abundant chaff (grape skins can substitute for legume) AND .17 cubic meter leaf hay or 22 pounds grass hay; optional crushed beans</td>
<td>29 instead of 22 pounds of grass hay</td>
<td>cut forage crops green</td>
<td>unlimited leaves</td>
<td>36 cups acorns and unlimited chaff OR 36 cups soaked lupines OR 16 cups bitter vetch with chaff OR 27 cups chickpeas with chaff OR 36 cups grape skins with chaff OR 29 pounds hay</td>
</tr>
</tbody>
</table>

It is unclear what role grazing plays in these recommendations. During the times of heavy work, such as spring plowing and late fall sowing, we can assume pasture does not play a role. However, it is unclear March through October whether the suggested feeds are in addition to some variant of the winter feeds or supplement to pasture. His recommendation for November and December for hay is only if none of the other suggested feeds are available. This is odd considering that is not the case during the other months. He may have wanted to save it for spring plowing. In light of today’s oxen feeding regimens, Columella’s suggestions actually seem fairly on-point. A
mature oxen needs to consume 1.7% of his body weight daily. For a 2,200 pound animal this means 34 pounds.\textsuperscript{70} The ancient recommendations seem comparable to this feed poundage in many instances, especially since oxen were probably smaller in most cases. The comparable poundage may suggest healthier than expected Roman oxen, but we also know that the ancients pushed their animals to do much more work than is expected today.

The general herd was driven to water twice in summer, once in winter while pasturing.\textsuperscript{71} Oxen drank in the farmyard. The importance of salt was also recognized.\textsuperscript{72} For fattening cattle, Pliny recommends washing them in hot water as well as cutting a hole in their side and blowing air into them with a reed.\textsuperscript{73}

**Breeding**

The characteristics of cattle changed significantly by region in ancient Italy: in the Apennines, tough but ugly; in Campania, small and white yet well suited to their native soil; in Etruria and Latium, powerful; in Umbria, a red type, but also huge white oxen, likely the ancestor of the modern Chianina.\textsuperscript{74} In selecting a pair of oxen for purchase, cattle in Gaul and especially those of Epirus were held in high esteem, though selecting animals already familiar with the native climate (temperature, elevation, vegetation) was regarded as most important.\textsuperscript{75} Purchase formulas existed for broken oxen—“do you guarantee that the said oxen are sound, and that I am protected from suits for damage”—and for unbroken ones—“do you guarantee that the said bullocks are quite sound and of a sound herd, and that I am protected from suits for damage.”\textsuperscript{76} Some of the points in the following chart which may strike
<table>
<thead>
<tr>
<th></th>
<th>Varro⁷⁷</th>
<th>Columella (taken from Mago the Carthaginian)⁷⁸</th>
<th>Palladius⁷⁹</th>
<th>Conroy, Oxen (2008)⁸⁰</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body</strong></td>
<td>full, not humpbacked, thick long neck with dewlap, well ribbed, broad shoulders</td>
<td>square, long muscular neck, dewlap almost to the knees, broad chest, huge shoulders, large belly, long sides, straight to slightly sinking back, round butt</td>
<td>blocky, solid, muscular neck, large dewlap down to knees, big chest, huge shoulders, not small belly, lengthy sides, straight back</td>
<td>large for breed, muscular shoulders, back, rump, and thighs</td>
</tr>
<tr>
<td><strong>Face</strong></td>
<td>wide forehead, big black eyes, hairy ears, narrow jaw, spreading nostrils, dark lips</td>
<td>wide forehead with curly hair, shaggy ears, dark eyes and lips</td>
<td>broad curly haired forehead, blackish lips and eyes, widely splayed nostrils</td>
<td>clear and bright eyes</td>
</tr>
<tr>
<td><strong>Horns</strong></td>
<td>black</td>
<td>long, blackish</td>
<td>crescent, sturdy</td>
<td>solid if head yoke is used</td>
</tr>
<tr>
<td><strong>Legs</strong></td>
<td>short, straight</td>
<td>compact, straight</td>
<td>solid, straight</td>
<td>strong, relatively straight</td>
</tr>
<tr>
<td><strong>Hooves</strong></td>
<td>not wide or splaying, two toes of equal size</td>
<td>large</td>
<td>large</td>
<td>dark, short toe, high and wide heel, not extreme</td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td>smooth</td>
<td>thick short hair all over; red or dark</td>
<td>thick short hair all over; red or dark</td>
<td>clean, healthy coat</td>
</tr>
<tr>
<td><strong>Tail</strong></td>
<td>long down to ankles, curling at end, thick hair</td>
<td>very long and bristly</td>
<td>long with coarse hair</td>
<td>alert</td>
</tr>
<tr>
<td><strong>Spirit</strong></td>
<td>placid but not lazy, confident but afraid of blows, not easily alarmed, not nervous at rivers and bridges, large appetite but slow eaters</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
modern breeders as irrelevant are related to sacrificial preferences.  

The advice for cattle conformation is similar across the board, perhaps most so of any Roman farm animal. The probable cause is that they are all drawing either directly or indirectly from the same authority, the treatise of Mago the Carthaginian. Columella and Palladius give separate qualities for the general herd:  

<table>
<thead>
<tr>
<th></th>
<th>Cow</th>
<th>Bull</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>very tall, long large belly, long dewlap</td>
<td>tall, straighter belly, larger neck than oxen</td>
</tr>
<tr>
<td>Face</td>
<td>very broad forehead, dark and wide open eyes, hairy ears, compressed cheek bones</td>
<td>fierce expression</td>
</tr>
<tr>
<td>Horns</td>
<td>smooth, dark</td>
<td>shorter than oxen</td>
</tr>
<tr>
<td>Leg</td>
<td>small</td>
<td>same as oxen</td>
</tr>
<tr>
<td>Hooves</td>
<td>moderate</td>
<td>same as oxen</td>
</tr>
<tr>
<td>Skin</td>
<td></td>
<td>same as oxen</td>
</tr>
<tr>
<td>Tail</td>
<td>very long</td>
<td>same as oxen</td>
</tr>
<tr>
<td>Temperament</td>
<td>at times fierce (Vergil)</td>
<td>calm</td>
</tr>
</tbody>
</table>

KD White points out that the complete lack of concern with the udder is likely evidence for the unimportance of dairy for cattle. Disregarding milk production when selecting cows could have been detrimental to the health of calves however, regardless of whether cow milk was ever a significant part of the villa’s diet. Varro believed that the color of the herd corresponded with hardiness. From best to worst: black, red, light bay, white.
Cattle were referred to with different names, as today, by age and sex: *vitulus/vitula* (calf), *iuvencus/iuvenca* (youth), and *taurus/vacca* (prime/breeding). Cattle in the fourth stage of life—beyond breeding age—were also referred to as *tauri* and *vaccae*, while a sterile cow was called a *taura* and a pregnant one a *horda*. Breeding age was significantly later than it is today. One possibility is that as cattle have become more domesticated over the last two thousand years, the onset of puberty has been pushed forward. Growth, development, and strength for mating and carrying young may have also been lower as a result of lower quality forage and feed. Suggested breeding ages and sex ratio varies much more widely than preferred conformation:

<table>
<thead>
<tr>
<th></th>
<th>Bull(^{87})</th>
<th>Cow(^{88})</th>
<th>Ratio(^{89})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td></td>
<td>2 minimum, better if 3; through 10</td>
<td>2:70 or 2:60 (one yearling bull, one two years)</td>
</tr>
<tr>
<td>Vergil</td>
<td></td>
<td>4 to 10</td>
<td></td>
</tr>
<tr>
<td>Columella</td>
<td>4 to 12</td>
<td>2 to 10</td>
<td>1:15</td>
</tr>
<tr>
<td>Pliny</td>
<td>4</td>
<td>bred at 1, though best at 2</td>
<td>1:10</td>
</tr>
<tr>
<td>Palladius</td>
<td>3</td>
<td></td>
<td>1:15</td>
</tr>
</tbody>
</table>

Varro seems to suggest that a yearling bull breeds, whereas Columella and Pliny will not use a bull until age four. The age of a cow’s first breeding also varies from age one to four, and sex ratio from 1:10 to 1:35. These fluctuations also have seemingly no correlation over time, ruling out breed development. The differences are most likely due to quality of feed available in each source’s specific case, and how much risk each farmer was willing to take with a young animal. Overall, the ages...
are much more conservative than they are in contemporary practices, in which cattle of both sexes routinely breed in their first year.

Bulls and cows were separated until breeding season which ran from mid-May through July for spring births on most farms.\textsuperscript{90} Pliny however states that breeding usually occurs in January, though sometimes in autumn or year round for people who depend on a constant supply of milk.\textsuperscript{91} In many cases, cows were bred annually once they were the desired age, though when available feed was low they were bred in alternate years. This system was especially used where cows were put under the yoke. They would alternate years of working and being pregnant. In this scenario the farmer was advised not to wear out a cow with work when she was nursing, and to provide \textit{cypisus}, toasted barley, and soaked bitter vetch to the cow, as well as ground millet mixed with milk to the calf.\textsuperscript{92}

Thirty days prior to mating feed was increased for bulls and decreased for cows, as females were thought to conceive better when a bit thin.\textsuperscript{93} Columella states that the female becomes most willing to breed as temperatures warm in the spring and there is abundant fodder, yet does not breed at their owner’s command, but of her own accord, probably referring to their heat cycle. Pliny seems to understand this cycle better, noting that if a coupling is unsuccessful, it should be repeated twenty days later. When a female refused the bull or he showed no interest, genital odor was brought to the nostrils.\textsuperscript{94} It was widely believed—based on a passage in Aristotle—that the sex of the offspring could be determined from the act of sex: if the bull dismounted to the left, a female was produced; if to the right, a male.\textsuperscript{95} Likewise, the left testicle was tied when a male was desired, the right when a female.\textsuperscript{96} Warmer
water—rainwater ponds rather than streams—was considered an aid to reproduction.  

Pregnant cows were usually pastured by day, preferably in well-watered, grassy and open ground with plenty of space, and then brought into stables at night. However, they were sometimes shut up in warm months in their enclosures to reduce irritation from flies outdoors. As the time of calving neared, particular attention was paid to their feed and temperature. It was recommended that births occur in the stables. Offspring were not allowed to sleep with their mothers out of fear that they would be crushed. Rather, they were kept in pens paved with stone to prevent hoof rot and sent to nurse in the morning and evening once the cows returned from pasture. Spring born calves were sent to pasture beginning after the autumnal equinox. Calves could be supplemented with a mash of grain and milk, and once on pasture might be given additional wheat bran, barley meal, and tender grass in the stables at night.  

Surrogate mother cows were a common practice. When a good milk-producing cow lost a calf, she would be given one from a lesser mother. If a cow got pregnant before the desired age, her calf was taken away—presumably to the butcher or a surrogate mother—and she was milked out for three days to avoid (what we call) mastitis. Cows from Altina, a town near Venice, were considered particularly good surrogate mothers, so much so that their own offspring were taken from them—presumably for slaughter—and they were given calves of other breeds whose mothers were either lost or overtaxed by work. This suggests that, though good
milkers, cows from Altina were not as desirable in other respects, such as capacity for work and meat, and so were not simply preferred as offspring in their own right.\textsuperscript{102}

Three types of castration seem to have existed: Varro’s preference is castration at age two, claiming that recovery is more difficult for them otherwise.\textsuperscript{103} This might suggest that physical development was indeed slower in ancient cattle. The operation took place during the spring or fall with a waning moon, and the animal was placed in the treatment corral. Two bars grabbed the muscles from which the testicles hang. A knife made a slit in the scrotum and the testicles were pushed out, keeping the rest of the extremities intact as this was thought to prevent excessive blood loss and feminization. It is reported that some people bred directly after this procedure—it’s still possible apparently—though this was highly discouraged as dangerous to the animal. The wound was smeared with ash and litharge of silver, and the steer was kept away from water and food that day. For the next three days, it was treated as a sick animal, fed medicinal plants and smeared with liquid pitch, ash, and oil on the wound.

On the other hand, though he acknowledges Varro’s procedure, Columella prefers Mago’s method of castration while the calf is still tener, tender. This method did not use a knife, but rather compressed the testicles with stalks of fennel, leaving no wound. Palladius however describes a third method which he prefers over the other two: the skin was bound tightly and compressed with a wooden bar in the spot where it was to be severed. The genitals were cut off with a red hot ax or hatchet, or an instrument that has been designed specifically for this purpose. He claims that a single stroke prevents much pain or blood.\textsuperscript{104}
Cattle were also branded with the *notas et nomina gentis*, insignia and name of the race, which classified them as either breeding, sacrificial, or working stock.\(^{105}\) An annual review of the herd and culling occurred in which old cows were either slaughtered or trained for work (sterile cows were believed to endure work as well as oxen).\(^{106}\)

**Health**

With the exception of Varro—who simply recommends that the *amentarius* repeatedly read Mago’s treatise on health—the sources devote an extensive amount of space to veterinarian medicine for oxen and cattle.\(^{107}\) Sick oxen were a major liability for farms which relied on them for plowing and transport. Considering the unorthodox feeds (by today’s standards) and the superstitious elements of Roman veterinarian practice, we might expect short life spans. However, cows could and were even expected to live until fifteen, bulls twenty.\(^{108}\) This claim may be on the upper end, yet if we take it seriously we might consider the role the conservative breeding age and alternating years of pregnancy may have had in lengthening the lifespan of cattle. The approach to cattle health can be separated into three realms: preventative, remedies for an infected herd, and remedies for individual sick oxen. The preventative measures rely on a mix of herbal concoctions and ritual application, particularly the number three:

1. Give to oxen to prevent sickness: 3 grains of salt, 3 laurel leaves, 3 scallions, 3 leeks, 3 heads of garlic, 3 grains of frankincense, 3 plants of ‘the Sabine herb’, 3 rue leaves, 3 stalks of bryony, 3 white beans, 3 live coals, 3 pints of wine
administered in a wooden vessel. This must be prepared and taken *sublimiter* (either “under the sky” or “standing”) for three days. A simpler mix is: crushed frankincense or savin and rue diluted with unmixed wine. You can also grate some *marrubium*, horehound, in oil and wine.\(^{109}\)

2. Every year when the grapes begin to change color: crush a snake skin—pick one up whenever you see it so you have it on hand!—spelt, salt, and thyme in wine and give to all the cattle to drink. You can also cut up some *scilla*, squill, and soak it in water, or use creeping thyme ground with sweet wine as well as bryony stalks and beans husks. Administer any of these over three days in doses of three *hemiae*.

3. Always provide clear water and access to salt.\(^{110}\)

4. As a general provision for health: administer *amurca* slowly at first by sprinkling it on feed, then—once they are used to it—give a mixture of *amurca* and water, as much as the ox will take, every four to five days.\(^{111}\)

5. Four times a year at the end of each season: crush in equal weight lupine leaves and cypress leaves, mix them with water and leave outdoor for a night. Administer for three days in doses of three *hemiae*.\(^{112}\)

6. At the first sign of illness: make the animal swallow a whole hen’s egg and on the following day leek mixed in wine *sublimiter* in a wooden vessel. Both the ox and the provider should be fasting.\(^{113}\)

7. The best defense against *scabies*, scab, is keeping animals well-fed and dry.\(^{114}\)

8. *Cystisus* is an excellent immune booster as a feed.\(^{115}\)

9. For ox hooves: smear with melted pitch before driving on a road.\(^{116}\)
10. It just as often happens that as ox is too fat as too thin. Don’t have muscles encumbered by fat.\textsuperscript{117}

11. Do not cause the herd to run too much, especially in the summer since this can cause diarrhea and fever.

12. Prevent chickens from entering the stables, as their manure is harmful. Keep out swine because they spread disease.\textsuperscript{118}

In the case of an ailment sweeping over the entire herd, the animals were separated and sent to distant points where no other animal was kept. Several medications could then be administered:

1. A mix of the herb \textit{panax} and eryngo roots with fennel seeds and wheat flour sprinkled into boiling water.

2. Equal weights of cinnamon, myrrh, frankincense, and sea-tortoise blood in old wine poured through the nostrils on three successive days.

3. \textit{Consiligo}, dug with the left hand before sunrise and inserted into the ear: a circle was made on the widest part of the ear flap with a bronze pin so that it bled on the inside and out; the middle of the circle was pierced and the \textit{consiligo} inserted; the wound was said to grip the root, drawing the disease to it and causing the circle to drop off, but saving the rest of the body.

4. Crushed up mistletoe in wine poured through the nostrils.\textsuperscript{119}

An exhaustive list of remedies for specific diseases and injuries is also given, mostly by Columella (and repeated by Palladius), though Cato and Pliny have unique contributions. They are for the most part written specifically for oxen, not the general herd.
1. **Indigestion** (*cruditas*): signified by the animal neither chewing cud nor self-grooming. Remedy with hot water followed by thirty cabbage stalks cooked and dipped in vinegar. The animal should abstain from other food for a day. Another cure is to keep the animal shut up so it cannot graze and mix four pounds of the tops of the mastic tree with wild olive crushed with a pound of honey in water. Keep in the open air for a night then pour down the throat. After four hours, give four pounds of soaked bitter vetch and keep away from other drink. Administer for three days. If the condition becomes severe enough that the animal is tossing in pain, tie the tail down and pour wine and oil down the throat, then drive it a mile and a half at a quick pace. If pain continues, cut the hoof all around and draw out the excrement from the anus with a greased hand, then drive again at running pace. If the condition still exists, administer three dried wild figs crushed in hot water. Then if necessary pulverize two pounds of wild myrtle leaves mixed in hot water and pour down the throat with a wooden vessel; bleed under the tail and bandage it with papyrus, then drive again at a quick pace until the animal is out of breath.\(^{120}\)

2. **Intestinal Pain** (*dolor intestinorum*): the sight of aquatic fowl, especially ducks, cures this.

3. **Colic** (*torminum*): signified by blood and mucous matter of the stomach.

Pound up fifteen cypress cones, fifteen oak apples, and the same weight of very old cheese and mix with wine. Administer over four days with tops of mastic and myrtle.
Aside from *torminum* being something that follows from *dolor intestinorum* if not treated, it is not entirely clear how the Romans understood the previous three conditions to differ from one another or how they correspond to modern veterinarian diagnoses. 

4. **Diarrhea** (*viridis alvus*, literally, “green belly”): keep the animal from drinking for two days and eating for one; afterwards, give wild olive, reeds, and berries of mastic and myrtle; alternatively, crush a pound each of bay leaves and southernwood, *abrotonum ceraticum*, in hot water and pour down the throat; alternatively, heat two pounds of grape skins and crush them in wine with mastic and myrtle tops and administer as the only drink; if pain does not stop, burn the middle of the forehead down to the bone and cut the ears with a knife, then rub ox urine on the wound and place pitch and oil on the cuts.

5. **Loss of Appetite**: when caused by swelling of the tongue, cut it back and rub the wounds with equal weights of salt and garlic. Wash the mouth out with wine and administer green herbs and leaves after an hour. If there is no tongue swelling, pour a mixture of pounded garlic and oil through the nostrils, or rub the throat with salt and marjoram, or smear with crushed garlic and fish sauce.

6. **Fever**: Signified by runny and contracted eyes, heavy head, flowing saliva, and slow respiration. Keep without food for a day then draw off a little blood from under the tail. After an hour, make the animal swallow thirty cooked cabbage stalks dipped in oil and pickled fish. Give these for five days on an empty stomach with tops of mastic, olive, or other tender foliage. Wipe lips
with a sponge and give cold water three times a day. The animal should be in
shelter until cured.

7. **Cough**: if treated early, barley flour with diced grass and crushed beans as
well as ground lentils mixed in hot water poured down the throat; if
longstanding, two pounds of hyssop infused in water with ground lentils; leek
juice with oil, leek fiber with barley flour, leek roots pounded with wheat
flour, and pounded bitter vetch with barley are also remedies.

8. **Suppuration**: cut it off with a knife, then wash it out with warm ox urine and
bind up with linen soaked in liquid pitch and oil, or—if it cannot be bound—
drip goat or ox tallow from red hot iron.

9. **Lameness**: believed to be caused by downward flow of blood into the feet.
   [Our sources are likely referring to founder (laminitis)]. If blood is still
gathered in the legs, dissipate it with friction. If blood has reached the hooves,
remove it by making an incision in the middle of the hoof and applying
bandages dipped in salt and vinegar. Cover the hoof with a shoe of broom and
keep dry. If lameness is caused by pain in the knees or legs, rub the area with
oil and salt until cured. Swollen knees should be warmed with vinegar and
moistened with ground linseed or millet in honey water. Apply sponges
soaked in boiling water then smeared with honey to the knees and wrap with
bandages (more details are given for variations of swelling).

10. **Scab**: several remedies are suggested. Rub with bruised garlic (as on rabid
dog bites); more effectively, pound ox-marjoram (*cunila bubula*) with
sulphur, cook it in *amurca*, and sprinkle on alum – smear this when the sun is
hot; mix a type of pitch called *pissasphaltus* with bitumen; have the animal eat *corchorum*, a type of pulse with healing properties eaten at Alexandria; apply black hellebore, frankincense, wax, and pitch.\textsuperscript{121}

11. **Hide Binding**: when the skin cannot be pulled away from the ribs, said to occur when the ox is too thin from sickness or became chilled from sweat. While heated from work, sprinkle with wine and put fat down the throat. Rub boiled laurel on the back, knead with oil and wine, and lift the skin.

12. **Ulcerated Lungs**: apply *consiligo* as for infected herd and give equal amounts of leek juice and oil with wine over several days.

13. **Bruised Neck**: draw blood (extensive directions are given on how to properly do this) from the ear or grind up *avia*, groundsel, with salt and apply to the affected part. If an ox absolutely refuses work, give it a few days rest and rub the neck with cold water and litharge of silver.

14. **Injured Hoof or Pastern**: wrap it with pitch, grease, sulphur, and wool and make a burn above the wound with a red hot iron (variations of the treatment are given for different types of wounds).

15. **Sprained Shoulder**: draw blood from the front leg opposite to the injured shoulder.

16. **Damaged Horns**: apply linen soaked in salt, vinegar, and oil for three days and on the fourth apply axle grease, liquid pitch, and crushed pine bark. Rub with soot when a scar begins to form.
17. **Sores** *(ulcera)*: drench in the morning with cold water. Apply pounded horehound or leek with salt and put on linen bandages with pitch, oil, and grease.  

18. **Snake Bite**: put crushed fennel in wine up the nose and swine dung on the wound. Or, scar the affected part with a knife and apply burdock pounded and mixed with salt. Mountain trefoil juice with wine is also effective as a drink. Crushing ash tree tops with wine and oil and applying as a drink and rub work as well (other bites—shrew-mouse, lizard—are treated with different remedies).  

19. **Eye Problems**: treated with honey in various forms. For swollen eyes, wheat flour in honey water. For white film on the eyes, rock salts pounded with honey. Cuttle-fish shell, *laserpitium* root, pearl barley, wild parsnip seeds, and wild radish juice are also used in various ocular remedies.  

20. **Leeches**: if the animal has swallowed a leech and it cannot be pulled out by hand, insert a pipe or reed and pour in warm oil. You can also put through the smoke of a burnt insect. If the leech is attached to the stomach or intestine, rather than the throat, pour hot vinegar down a horn.  

21. **Lethargy**: force a hen’s egg down the throat onto an empty stomach and the following day crush leek or garlic in wine and pour into the nostrils.  

22. **Worms**: most harmful to calves; insert pellets of either crushed half-cooked lupines or ground wormwood with dried figs and bitter vetch down the throat. One part grease to three parts hyssop works as well, as does the juice of horehound and leek.
Pliny also suggests several ways in which cattle products can be used for health in other animals:

1. Ox blood is a remedy for scab in dogs when washed off with lye ash.
2. Lethargy is helped by consuming calf’s dung boiled in wine or by smoking the manure of a grass fed cow through a reed.
3. Applying the burnt pastern bone of an ox to loose and aching teeth tightens them.
4. Coughs are soothed by ingesting the tip of a cow horn burnt to ash.
5. Headache is relieved by drinking after cattle.\textsuperscript{128}

\textbf{Draft}

Though donkeys and mules were also employed as draft animals, there is no doubt that working cattle were the most important power source for Roman farms. Depending on the specific soil and financial circumstances, the working animal was sometimes a cow, though normally an ox. Maintaining healthy and capable oxen was just as important as having well sharpened plows and efficient workers.\textsuperscript{129} Farms on the scale of our sources maintained two to three yoke of oxen—normally a pair for every fifty to seventy five acres of land—and normally as many \textit{bubulci}, ox drivers.\textsuperscript{130}

Oxen were trained at the villa where they would spend the rest of their lives. There were several ways to acquire animals for training: by maintaining a larger herd of suitable cattle at the villa, by acquiring animals from another villa, or by capturing wild cattle. Oxen were normally trained between three and five years of age – much
later than the contemporary ‘New England’ method in which training begins for the animals when they are calves.\textsuperscript{131} However, it was recommended that any animals destined for the plow be handled as calves and become accustomed to tie-stalls to ease the training process later on.\textsuperscript{132} Though not mentioned by any of the other sources, Vergil does describe training \textit{vitulos}, calves, by teaching them with ropes rather than yokes at first. He recommends feeding grain in addition to grass and not milking the mothers so that the calf can have the full supply of milk.\textsuperscript{133}

The preferred method of training was simply placing the unbroken animal into a yoke with the most well-trained ox available (though they should be fairly evenly matched in strength). If particularly stubborn, it would be placed in a triple yoke in between two well-trained oxen so that it was forced to keep up.\textsuperscript{134} If no well-trained oxen were available, training began for mature cattle by tying them to a post in the ox-shed and fastening their horns with hempen cords wrapped in wool to avoid causing a sore. Especially if the steer was wild-caught, a spacious enclosure with easily accessible exits was necessary.

If the animal was relatively calm, it was driven out that day and made to walk a thousand paces in an orderly manner. Once it returned to the shed, it was bound closely to the posts so that it could not move its head. The trainer then approached from the front talking in a soothing voice, rubbed the steer’s nose, and stroked its hide while sprinkling it with wine. For more human interaction, the trainer rubbed the belly and removed ticks. The steer then had its tongue pulled out and rubbed with salt before being fed a pound of meal with fat drippings. The final step was pouring wine down the steer’s throat through a horn. After three days of this routine, the animal
was considered tame and yoked on the fourth day. However, if the animal was angry at the initial tying, it was left for a day and night to ‘expend its fury.’ The next morning, the animal was driven out with several people in back holding onto the cords and someone in front maintaining the desired pace and giving out light blows with a willow stick. Throughout the process it was considered important that the animal not kick anyone as the habit would not be easily expelled.

At the first yoking, a branch of a tree was tied on rather than a pole. Weight was gradually added starting with an empty wagon. Loads and journeys were increased until the animal was first put to the plow on already worked ground. Two types of yokes were known to the Romans, the head/horn yoke and the neck yoke, the latter of which was recommended as it was thought to take better advantage of the animal’s strength and improve its gait.¹³⁵

A tall, intimidating plowman was recommended, though someone more terrifying in voice than cruel with the lash whose vires, strength, was tempered by clementia, kindness.¹³⁶ Anytime an ox lied down while plowing, Columella recommends—rather than using a goad or fire as some apparently did—tying its feet so that it cannot stand up and get to feed.¹³⁷ The goad was in fact strongly discouraged by Columella as making oxen irritable (not to mention it’s painful and cruel), though he advocates moderate employment of a whip.¹³⁸

Two men were involved in the plowing process, one holding the switch/whip and directing the oxen, the other holding the soil working implement, attached to the yoke by a beam. Whether in grove or field, it was recommended that a furrow was not run more than one hundred twenty feet. When this distance was reached, the yoke
was pushed forward on the animals’ necks to allow them to cool off. Oxen occasionally switched sides of the yoke. Furthermore, after unyoking, points of contact between the animal and yoke were rubbed, and wine was poured down their throats if they were particularly warm. The oxen were not tied until they stopped sweating. They were given a little food at first, then water, and finally a larger portion of feed.¹³⁹

This process suggests several things: first, that the yokes were not well-fitted and particularly rough on the oxen’s necks; second, that the angle of draft between the yoke, beam, and plow probably was not optimal for ease of pulling; finally, that the process of tending the fields and orchards with oxen was very time intensive. Hundreds of these 120 foot passes were made to work up an acre of land, so stopping after each would have ensured a long day in the field. Imagining these passes at two miles per hour, we can see how arduous this process would have been.

In addition to soil working, oxen were used for transportation and other tasks around the farm. Training an animal for transportation employed similar methods: first accustoming a pair to an empty cart in town to introduce the animals to noise and traffic before hauling heavier loads.¹⁴⁰ In addition to horses, cattle were also used to thresh grain, either by turning in a few animals from the herd to trample it, or by using oxen to pull a sledge over the grain.¹⁴¹

Manure

Cattle manure was certainly employed as a fertilizer, though appears not to have been as highly regarded for this purpose as it often is today. Columella ranks it
behind that of every farm animal except for aquatic birds and swine.$^{142}$ Cato recommends clearing out the bedded ox stalls during bad weather when other tasks cannot be done, and applying it during the fall.$^{143}$ Two pits were maintained: one for fresh manure, and one for older, composted material. These were protected—both from drying out and leeching—by branches and leaves. Piles were filled for a year with fresh material until they were left for another year before being spread. The bottoms of the pits were packed hard to keep moisture from draining away and occasionally moistened, since it was recognized that optimal water content helped heat the compost so that weed seeds would not be viable.$^{144}$

Crop fields were spread with composted manure between the first and second pass of the plow at a waning moon, as this was thought to discourage weed growth. Columella states that he applies twenty-four loads of 80 $modii$ per $iugerum$, converting to roughly twenty-two cubic meters of compost per acre, a heavy application for grain.$^{145}$ This would be considered a suitable application for many established organic vegetables soils today, so is quite heavy for field crops.
Sheep

The Romans were a people sprung from shepherds: the nation’s mythology recounts the adoption and upbringing of the abandoned twins Romulus—Rome’s namesake—and Remus by the shepherd Faustulus and his wife. Varro furthermore reports that sheep were the first domesticated animal on account of their natural placid disposition as well as their utility, though wild sheep existed in his time in regions such as Phrygia. On his account, sheep were the primary means of survival in the pastoral stage of human development, which occurred between foragers and his contemporary civilization. The animals provided pastoral people a milk, meat, and cheese based diet as well as wool for warmth.\textsuperscript{146} Columella reports peoples who, bereft of grain, continue to exist as “milk drinkers,” with the sheep providing a hearty portion of their diet.\textsuperscript{147} Furthermore, along with pigs and cattle, many of the nation’s rites and family names can be traced back culturally and linguistically to sheep, according to Varro.\textsuperscript{148} While the reality of Rome’s development clearly is more nuanced than either its mythology or Varro’s simplistic account would suggest, at a minimum the cultural importance attached to these accounts suggests the significance of sheep in the Roman world.

The reality of sheep rearing in classical Roman times would have been more nuanced than Varro’s linear account of human development. While forms of transhumance, in which the sheep and shepherds travel miles between seasonal pastures and there is no stall feeding—in many cases—except during lambing season, certainly would have been more pervasive prior to our literary sources, it is likely also that forms of such lifestyles continued on the Italian peninsula through Varro’s time.
(he himself reports separate summer and winter pastures). Centuriation, the division of land into settler plots by the state, certainly would have cut into the land base of traditional shepherding cultures. Yet, much land would have remained undivided, particularly in the uplands, and practically the state would have had no way or desire to oversee all the land on the peninsula, even when policies were encouraging sedentary farm life. It is furthermore possible that our sources, all of them landowners, simply were not particularly well informed about the life of shepherding people in the uplands. The type of sheep rearing that our authors’ focus on, relatively small flocks based out of farmsteads, would have coexisted with transhumance shepherding practices, as well as—by Varro’s time—larger ranches or latifundia, though these types of large estates with thousands of head of sheep were only beginning to take hold. These large ranches were certainly foreign to Cato, whose model farm includes 100 head of sheep. He does, however, mention terms of leasing sheep, yet another way these animals were raised. In this sharecropping scenario, annual contracts would be entered into between villa owner and lessee, rather than the owner having his own full time shepherd.

No matter how they were raised—by transhumance, on a large ranch, in a small farmstead by the owner, or through a lease—sheep were undoubtedly the critical source of clothing for the Roman people. Despite the consumption of fresh milk, meat, and cheese, wool was the most important product derived from this animal, as it was used extensively by all classes for clothing, blankets, and rugs, at least through the first century AD, when linen gained popularity. While roaming herds could top one thousand in number, in which case around one shepherd per
twenty sheep would accompany the flock with pack animals loaded with supplies and women to prepare meals, in the context of our authors, the *magister pecoris*, master of the flock, would be based out of the farmstead. This position corresponds to the *vilicus*, overseer of the crops, a trusted slave or servant. In this scenario, Varro states that either one or two shepherds per one hundred sheep were necessary, depending on breed. The herdsman was to be vigilant and energetic: while allowed to threaten with voice and staff, he was advised never to throw anything, nor to ever sit down or stray from the flock.

**Housing**

Built housing varied according to landscape, available materials, and type of system, be it based out of the farmstead, transhumance, or ranch. Even on an open range system, flocks were brought into shelters, *ovilia*, at night for predator and thief protection. These *ovilia* included lambing pens, in which birthing ewes would be separated, and also included pens for sick sheep. They were bedded with straw or fern, which provided cold weather protection and prevented foot rot by soaking up moisture. Our sources recognize the importance of bedding to maintain flock health, hoof structure, and wool quality, and advise that no standing water or moisture from urine should be present, especially in the birthing pens. Varro also states that adding fresh bedding every few days increases the animals’ appetites. If straw and fern bedding materials were in short supply, oak leaves would also be used. Pliny furthermore suggests that grass could be pulled up from around the osier beds and used for bedding. For the Tarentine breed, particularly prized for its wool, it was
suggested that perforated boards be laid on the floor of the shelter with a daily sweeping to remove any moisture. Great care was also taken to keep any mud out of the shelter for this high quality wool breed. It seems that in this situation daily sweeping replaced bedding since little bits of chaff and other plant material could become entangled in the prized wool.  

Permanent shelters in the farmstead system may often have been long, low, three sided structures whose primary purpose was to protect against the wind, provide lambing quarters, and facilitate feeding. While Varro advises readers to face the structure east, Columella states that the shelter should face the midday sun. A slight slope was recommended to facilitate sweeping out. Temporary shelters in the ranging systems may have been constructed from reeds. For these ranging situations in which winter pasture could be miles away, Varro states that shepherds carried *crates* or *retia*, the former often translated as wicker work or hurdles and the latter nets. Varro’s exact meaning is unclear here, but we can assume he is referring to some sort of light frames and coverings by which to make temporary shelter. In the farmstead systems in which our sources operated, the shelter would have been the ‘home base’ out of which the flock was driven to various pastures according to the season.

**Feed**

The historical norm in Italy prior to our sources was transhumance or a semi-nomadic system in which feed was supplied from pasture, with shepherds accompanying the flock many miles in search of acceptable fodder with the changing
seasons. The Mediterranean climate, given more or less unrestricted land access, would have provided enough green pasture to get the flock through the winter. However, in the farmstead situation with limited pasture and only micro variation in climate, winter feeds would have been necessary. The variation in Republican and Imperial times was wide, and even within our sources, the approach to pasturing and feed lies on a spectrum.

Whatever the system, pasture would have been the basis of almost any program. Preference was given first to vegetation that arose after a recent plowing, then to permanent meadows free of marsh. Bogs and woodland were considered undesirable for sheep. Our sources also recognized that any pasture would decline in productivity if continually grazed, and they advise that salt be provided in troughs or sprinkled over the pasture during the summer as a remedy. Salt access for the ewes was known to increase the supply of milk and quality of cheese.\textsuperscript{168} However, while salt is indeed important for sheep health, this remedy alone would not have rejuvenated pastures, presenting a challenge for the farmstead approach.

Good shepherds would move the sheep at an appropriate speed, allowing them to have suitable time to graze an area, but not wear down any one spot too much. Grazing sheep on either stubble, after harvested grain, or on a field preceding plowing for grain growing, was also a popular tactic.\textsuperscript{169} The sheep provided manure and nutrients to the cropland while foraging for their own feed. A variation of this method could also be carried out in the winter, in which the flock was fed leaves on the land to be put in grain the next season.\textsuperscript{170} Another option still popular today was grazing orchards with sheep when there was no grain crop between the olive rows.\textsuperscript{171}
During the summer, the sheep fed during the early morning on the dewy grass and were driven to water at the rising sun or within the next few hours. At midday, the shepherds sent them to shady places, under cliffs or trees, resuming open pasturing later in the afternoon before returning to a water source around sunset.\textsuperscript{172} The sheep were driven with their backs to the sun: moving west before midday and east after midday during the warm months.\textsuperscript{173} During the winter, the sheep were only let out after the frost had melted, and were brought to water just once at midday. Columella states that when ruminants feed on frosty grass it can cause \textit{gravedinem}, translated as a cold or catarrh.\textsuperscript{174}

While some grass hay was fed to sheep, it does not seem to be the primary winter feed like it is on many contemporary farms. The amount of winter feed necessary would have depended on the stocking density and land base of the farmer, since it was possible for the sheep to forage through the winter. For the farmstead system, leaves seem to be a staple, especially on farms which did not have a ready supply of other harder to obtain fodder. Cato suggests that elm and poplars should be planted to provide leaves for sheep and cattle, and to feed them out as long as they last.\textsuperscript{175} Beyond leaves, other winter foods included hay, chaff, \textit{cytisus}, and vetch, as well as barley, chickling vetch, and \textit{cicerula} (a small type of chickpea), though these were considered expensive.\textsuperscript{176} Fig leaves, straw, grape dregs, bran, \textit{medica}, clover, willow, and broom were fed out to fatten and increase milk production regardless of season in the farmstead system.\textsuperscript{177} Pliny also mentions sheep grazing upon thyme.\textsuperscript{178}

Speaking of the Tarentine breed, which is noted for its high feed requirement and quality wool, Columella feeds seven Roman pounds (five U.S. pounds) of hay or
pulse chaff and either three *sextarii* (about seven cups) of barley or beans or four *sextarii* (about nine cups) of *cicercula* (chickpea), along with leaves, *medica*, or *cytisus*. Five pounds of hay plus two pounds of barley per head, if this suggestion matches the reality, was a generous amount. In most cases and for almost all breeds, a farmer probably was not willing or did not have the means to feed out this much. The Tarentine breed, however, was often fed in the fold only—Palladius, for instance, suggests this—and needed a large amount of brought-in fodder since its pasture was limited or non-existent.  

**Breeding**

Pliny and Columella both state that there are two sheep *genera* (classes): the former refers to them as *tectum* (covered) and *colonicum* (common), the latter *molle* (soft) and *hirsutum* (rough). Yet, it is unclear whether these were thought to be two ‘breeds’, in the way we conceive of that word today. Multiple sources refer to different types of sheep, distinguished by color, geographic origin, and product in ways that could be conceived of as breed more so than the covered/common or soft/rough distinction. KD White cautiously reports a list of four breeds that R. Billiard identified as known to the Romans: Etruscan (modern Bergamasca), Tarentine, Greek (modern Maltese), and Merino. Though this list is speculative, it is clear that our sources do make some distinctions of the sort: Varro and Pliny, for instance, distinguish between characteristics of Italian and Syrian sheep; Pliny mentions crossing Spanish and Corsican sheep with the mouflon to create the ‘Umbrian’; Columella mentions crossing with African rams and clearly distinguishes
the characteristics of the Tarentine, known for its fragility and high quality wool.\textsuperscript{182} Furthermore, color was noted as a significant distinguishing factor, though this does not necessarily indicate breed: multiple sources assert that if white lambs are desired, a ram with white fleece and a light, uniform tongue is necessary.\textsuperscript{183}

The Romans then distinguished between sheep in several different ways, none of which may perfectly correspond to our conception of breed. Moreover, the \textit{tectum/colonicum} and \textit{molle/hirsutum} distinction likely refers simply to the sheep of higher quality wool, which would be jacketed and kept in especially clean conditions for spotless fleece, and those commoner sheep which were kept for lower quality wool, milk, and meat.\textsuperscript{184}

Regardless of breed, it is clear that the Romans looked for specific conformations and qualities in their sheep. Insofar as these corresponded to a breed improvement program, Joan Frayn notes that it would have been primarily to improve wool quality, quantity, and color, not milk and meat.\textsuperscript{185} Mature, but not old, sheep were desired for starting a flock. Varro gives this purchase formula:

“you guarantee that the sheep in question are perfectly sound, up to the standard of a flock which is perfectly sound, excepting those blind of one eye, deaf or smooth bellied, that they do not come from a diseased flock, and that the title may legally pass—that all this may be properly done?”\textsuperscript{186}

The table below summarizes the desired physical qualities, though, as Columella notes, the sheep should match the region: tall in flat country, square in the hills, small in woody mountains, coated in meadows.\textsuperscript{187}

There is a clear fixation among the Romans for white fleece, which was desirable for garments. Columella has an extended discussion on the Tarentine breed in particular,
<table>
<thead>
<tr>
<th>Author</th>
<th>Body</th>
<th>Fleece</th>
<th>Color</th>
<th>Ram</th>
<th>Horns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>full body, shaggy belly</td>
<td>abundant, soft; long, thick fiber</td>
<td>white</td>
<td>full fleece on forehead, grey eyes, wide chest, wide long tail, ears covered with wool; avoid black or spotted tongue</td>
<td>rams should have horns curving toward muzzle</td>
</tr>
<tr>
<td>Vergil</td>
<td></td>
<td></td>
<td>white</td>
<td>reject if black or spotted tongue</td>
<td></td>
</tr>
<tr>
<td>Columella</td>
<td>broad forehead, long tail; no small ewes; large frame</td>
<td>hanging woolly belly; thick fleece; shaggy abundant, but not coarse neck hair</td>
<td>white is best, though black and dark brown get good price; red exists; no multicolored ewes</td>
<td>white fleece, palate, and tongue; breadth and height; large testicles</td>
<td>best without, except in windy, rainy climate; curling better than straight</td>
</tr>
<tr>
<td>Pliny</td>
<td>short legs</td>
<td>woolly belly</td>
<td>more useful if mutilus: bore a hole in the horn close to ear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palladius</td>
<td>broad forehead, very long tail</td>
<td>soft-fleece, woolly belly</td>
<td>white</td>
<td>tall, long, large testicles</td>
<td></td>
</tr>
<tr>
<td>Simmons, Ekarius, <em>Storey's Guide to Raising Sheep</em> (2009)</td>
<td>straight back and belly, strong chest, correct bite</td>
<td>shiny, even coat; no wool on face</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
noted for its commercial value and novelty. These sheep were seldom fed outside, but rather assiduously attended to within spotless enclosures. If they were allowed to pasture, a clear field without brambles was recommended to avoid entanglement in the wool. Normally though, this would be a ‘jacketed’ breed: the sheep would wear a covering to protect their wool from the elements and entanglement. These jackets were routinely removed, and the sheep were soaked in wine and oil. They were thoroughly washed three times a year. The ewes were not of high milking quality, and Columella recommends having more males than normal for this breed, who were castrated before breeding age and killed at two for the profit of their skin.

There is also a clear bias toward the ram: no sources mention udder health when selecting a flock. Furthermore, wool quantity was given preference by the ancients over shine and evenness, better indicators of health. The Romans also make no mention of foot form or mouth conformation, two heavily weighed indicators of health today. However, the Romans were much more conservative about the proper age to breed:

<table>
<thead>
<tr>
<th>Author</th>
<th>Ewe</th>
<th>Ram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>not bred at less than two; three years best</td>
<td>best at three; through eight years</td>
</tr>
<tr>
<td>Columella</td>
<td>after second year through seventh; still young at five</td>
<td>breed from two to nine or ten years old</td>
</tr>
<tr>
<td>Pliny</td>
<td>breed from two to nine or ten years old</td>
<td>breed from two to nine or ten years old</td>
</tr>
<tr>
<td>Palladius</td>
<td>breed from two to seven years; best at five</td>
<td>breed from three to eight years</td>
</tr>
<tr>
<td>Simmons &amp; Ekarius (2009)</td>
<td>first estrus typically at six month</td>
<td>best ram two years old; use a young ram sparingly</td>
</tr>
</tbody>
</table>
Sheep are the one farm animal for which the Romans consistently preferred fall birth: most sources preferred that ewes were bred May through July for an October to December birth. Columella however states that an older ewe could be bred in April, giving the lamb a longer fall to grow strong for the winter. The fall birth reduced the danger of heat for young lambs, though the return of consistent rain and fall pasture growth was also a significant reason. Rams were removed from the flock two months before mating and given more food—such as barley—one month out to increase vigor. Ewes, however, were given less food, as it was thought thinness encouraged conception (this is directly opposed to the modern idea of ‘flushing’, in which ewes are encouraged to gain weight before conception through richer pasture or grain). After conception, the rams were removed so as not to bother the pregnant ewes. While this was the preferred method, some farmers did let their rams breed indiscriminately throughout the year, meaning lambs were born at every season. Several breeding superstitions come across in the literature as well:

1. Pliny states that claps of thunder cause miscarriage if the ewe is solitary, so she should be kept in the flock (while the thunder aspect is obviously superstition, this maxim could simply represent the sound advice to keep herd animals in a herd).

2. Owing to a passage in Aristotle, it was widely believed that male lambs were conceived when a north wind was blowing, and so if males were desired the flock should be pastured in the direction of the wind; likewise, female lambs were conceived at a southerly wind.
3. Additionally, Columella states that, as with horses, a ram’s left testicle should be tied for male offspring, right for female, though this is hard to do in a large flock.  

4. Varro recommends that ewes drink the same water throughout the breeding period, as a change influences womb and wool. Likewise, Pliny clearly believes that different water sources cause different colored wool. 

Each ewe was given a pen for lambing and kept enclosed in it with her lamb(s) for two to three days. Assisted births were encouraged, even cutting the lamb to remove it while saving the ewe if necessary. After a successful birth, a fire was sometimes placed near the lambs for warmth as well. Any lamb which would not nurse was held up to its mother’s teats and its lips were smeared with hog lard or butter. However, before this occurred, Columella and Palladius both recommend drawing off the colostrum, as they believed it was harmful to lamb health. From the modern perspective, this is a grievous error, as colostrum—the first milk produced after birth—contains antibodies from the ewe’s immune system which should be absorbed into the lamb within twenty four hours after birth.

After a few days, the ewes would return to pasture during the day, with a nursing session in the morning and the evening, after which they would again be separated for the night. At ten days after birth, lambs were fastened to stakes to discourage frivolity: Varro suggests that they be tied by ropes so that they do not knock skin off themselves while frisking about; Columella suggests confining them at this time in a osier bed and separating the strong and weak ones to prevent bullying. Yet, a few days after this, he appears to send the lambs to pasture, and recommends
giving ground vetch or tender grass before and after being turned out. Palladius likewise recommends bran, *medica*, or barley meal for lambs, while Columella suggests *cytisus, medica*, bran, and—price permitting—barley flour and bitter vetch. This treatment continued until four months of age at which point the lambs were weaned, a process which our sources recognized can be stressful for the lambs. Up until that point, many did not milk the ewes, and some who were concerned primarily about wool quality did not milk at all. Castration did not occur until the fifth month.202

While an operation that primarily concerned itself with wool might never milk most of the ewes, a suburban farm would often choose to send lambs to the butcher in town and market milk or cheese.203 Villas farther out in the country would usually choose to pasture the lambs. Even in a farm near a city, though, at least one in five lambs was kept as flock replacement.204 Lambs would have been removed especially from the younger ewes. While our sources bred ewes at two years of age, Columella states that they were only fit to raise their young between four and eight years of age.205 It is unclear to what extent this practice was implemented, but it is interesting to note how far away from a ‘natural’ breeding program it is: the flock was carefully managed rather than allowed to breed and raise young without much intervention.

Health

Though noted to have trouble in both cool and warm weather, the perception of sheep was generally that they were of good health and relatively less prone to contagious disease than some other farm animals.206 Nevertheless, the *magister*
pecoris was advised to carry written remedies with him. One of the main concerns was keeping a healthy, clean coat of wool. As discussed above with the Tarentine breed, one approach was to jacket the animals and keep them on paved ground in their enclosure.\textsuperscript{207} For most sheep, however, an emphasis on post-shearing treatments, bathing, and preventing the mite infestation scab predominated.

Shearing occurred during the spring at the waning moon.\textsuperscript{208} While clippers were normally used, some peoples continued the method of simply plucking the wool off.\textsuperscript{209} Treatments after shearing are recorded as far back as Cato who recommends mixing equally old strained \textit{amurca}, water in which lupines were boiled, and wine dregs, then smearing them on the now bare skin. After a couple days of sweating, the sheep were washed in the sea or salt brine. The process was thought to prevent scab and ticks and increase wool quality.\textsuperscript{210} Columella and Palladius repeat their predecessor’s mixture, while Vergil gives a variant: a mixture of \textit{amurca}, \textit{spumas argenti} (litharge of silver), sulphur, pitch, wax, squill, hellebore, and bitumen.\textsuperscript{211} In addition to the post-shearing treatment, regular washing was common. Palladius recommends that sheep be washed three times a year in sunny weather and rubbed in olive oil and wine.\textsuperscript{212}

Scab, an infestation of several kinds of parasitic mites which causes skin inflammation, crusting, and wool loss, was the health concern most covered by the Romans for sheep.\textsuperscript{213} While the post-shearing treatment was the preferred preventative method, our sources also list extensive remedies should infestation occur. Vergil notes that the condition usually occurs in winter, when there is chilly rain or unwashed sweat, and recommends bathing the whole flock in streams.\textsuperscript{214}
Columella claims to observe several causes: a cold winter, not soaking and washing after shearing, and especially lack of fodder. When a sheep has been observed to gnaw at the affected area and rub against trees, he recommends that the wool be drawn apart and inspected. His remedies include:

1. A mixture of crushed white hellebore, wine lees, amurca, and boiled lupine juice (essentially a variant of the post-shearing treatment).
2. The juice of green hemlock mixed with salt that has been buried in an earthenware vessel in dung for a year and applied heated after rubbing affected area with pumice.
3. Boiled down amurca or stale human urine in which hot tiles have been plunged.
4. Heated urine, green hemlock juice, and salt.
5. Boiled ground sulphur and liquid pitch.

Palladius also suggests several remedies which should be rubbed on:

1. The liquid from boiled Cyprus cones.
2. A mix of sulphur, galangale, white lead, and butter.
3. The urine of a donkey which happened to be standing in the road.
4. Cedar resin, as they use in Arabia.

The most concerning part of the Romans’ veterinarian ideas for sheep is clearly the suggestion that lambs not drink their mother’s colostrum, but rather that the farmer draw this off. Given this suggestion, it is actually somewhat surprising that more problems with lambs are not noted, so it is unclear how often a shepherd would really have followed this advice. Columella and Palladius, the two sources who
suggest this practice, also advise that sick lambs should not nurse, but rather should be separated and given a mix of their mother’s milk and water or goat’s milk. Goat’s milk was also used as a general medicine for lambs, poured down their throat with a horn. The one disease specifically noted for lambs is called *ostigo*, described as a condition of sores on the mouth and lips. It was thought to have arisen from allowing lambs to graze dew covered grass, even though this was encouraged for mature sheep. The prescribed remedy for this potentially fatal disease was to rub ground up hyssop and salt equally by weight and apply this to the mouth and tongue, then wash the sores with vinegar and smear with liquid pitch. Alternatively, some applied heated rust and grease; others washed the sores with crushed cypress leaves and water.²¹⁶

As in other animals, there was a concern about diseases that spread rapidly and affected the whole flock, first indicated by a sheep often withdrawing to shade, lagging behind, nibbling only the top of the grass, or sinking while grazing.²¹⁷ It was recommended that such a situation be addressed immediately. In the case of the ailment spreading to the whole flock, it was suggested that a change of fodder, pasture and watering place occur. Columella also suggests that a flock recovers better if divided up among the *coloni* (farmer, husbandman, colonist). This seems like an odd suggestion to give away a sick flock in pieces to others who would probably not be happy to have them. Frayn however notes that *coloni* here most likely means tenant farmers already on the estate.²¹⁸

Other ailments and remedies noted include:

1. **Asthma and Respiratory Illness**: cut the ears with a knife, and transfer the sheep to another location (cutting the ears probably did nothing, but if the
respiratory problem was caused by a dusty enclosure, moving them would help). Also suggested for lung problems was inserting lungwort into the ear, as with pigs. Alternatively, Celsus states that sour vinegar should be given, or stale, heated human urine should be poured down the left nostril through a horn and grease down the throat.\textsuperscript{219}

2. **Lameness**: divided into two types, the first of which is described as chafing, discharge, and division in the hoof, with a suggested cure of either liquid pitch; a mixture of alum, sulphur, and vinegar; unripe pomegranate pounded up with alum and steeped in vinegar; putting copper rust on the area; or burnt *galla* (oak apple/gall) pulverized in dry wine. The second type is a boil, described as having a hair growing out of it and a ‘worm’ underneath. It was addressed by cutting around it carefully with a knife, being careful not to injure the ‘creature’ underneath, since otherwise it was said to release poisonous fluid that soaks the wound. After cutting, hot tallow was dripped on the wound with a burning torch.\textsuperscript{220} It is unclear whether these two correspond at all to foot rot and foot scald.

3. **Fever**: bleed either between the two parts of the hoof or at the pastern, as well as beneath the eyes and from the ears.\textsuperscript{221}

4. **Vertigo**: boil wild beet greens and pour the liquid down the sheep’s throat, then feed the beets.

5. **Protection from wolves**: hang squill from the neck of the lead animal.
6. **Protection from snakes**: place in the stall women’s hair, galbanum, stag’s horn, goats’ hooves, bitumen, castor, stinkwort, calamint, santolina, or anything with acrid odor.

7. **Lice and ticks**: rub with cedar resin.

8. **Erysipelas**: a difficult disease which causes red spots on the skin and can spread to the whole flock; pour on goat’s milk. Bolus of Mendesium suggests frequently examining the flock and burying alive any sheep with this condition near the fold and having the rest of the flock pass over it.

9. **Jaundice**: have the sheep ingest stale human urine.

10. **Rheum**: mucus discharge from the eyes, the word here is *pituita*, translated as the ‘pip’ for fowl; insert stalks of *cunelae bubulae* (ox-marjoram) or wild mint wrapped in wool into the nostrils and turn them until the sheep sneezes.

11. **Broken legs**: as with humans, wrap the legs in wool soaked in oil and wine, then put on splints.

12. **Bad breath**: cut the ears with a knife.

13. **Lack of appetite**: tie its tail tightly with its own plucked wool; it will eat and the tail will fall off.

14. **Aggressive ram**: tie a spiked board to its horns with spikes facing the forehead in such a way that when he butts he hurts himself. Epimarchus of Syracuse suggests piercing the horns near the ears at the point where the horn bends.

Preventative measures and non-specific measures are also suggested, such as mixing pounded sage and horehound in the water for two weeks each in autumn and
spring, giving *cytisus* fodder or cane roots, giving a viper burned in a jar with salt, giving juice from the root of centaury, giving *herba lanaria* to encourage milk production, and keeping them away from bees, which become entangled in their wool.\textsuperscript{226} Sheep products, including manure, also were considered to have several uses for human health as well:

1. Sheep lungs, especially of rams, can be used to return scars to natural color.
2. A concoction of dried ram testicle, sheep blood, and lamb gall can be used as a cure for epilepsy.
3. Sheep sweat is useful for eye inflammation.
4. A ewe’s afterbirth is useful for *muliebris malis*, women’s complaints.\textsuperscript{227}

**Manure**

Sheep dung was considered by Palladius to be of lesser quality than donkey, though equal to that of other draft animals and goats.\textsuperscript{228} One of the main ways sheep manure was utilized was grazing of grain land before, during, or after growth. Grazing sheep over next year’s grain crop provided manure to be plowed in. The flock, depending on availability of feed, could be fed leaves on the area for a longer period of manuring once the pasture ran out in that particular field. Grazing after the grain had been harvested trampled the straw and allowed the sheep to glean. K.D. White, drawing from Vergil and Pliny, also describes a practice in which seed was thinly sown in southern regions, producing excess side shoots and vegetative growth in a grain crop. Sheep were driven to the field and allowed limited access to graze the vegetation while manuring the crop, which was able to recover because of the wide
spacing. Other mentioned uses include fertilizing apple trees with sheep manure mixed with fine ash, as well as treating wounds in vines by smearing sheep manure on and binding it.

Sheep manure could also be collected elsewhere and then applied to a meadow, garden, or field crop. A variety of strategies appear to have been used for collecting manure in the shelters. Some farmers, particularly for the Tarentine breed, seemed to have swept out manure and moisture daily, aiming to keep a dry wooden floor on which the sheep could rest without damage to their wool from either moisture or bedding. Most of the time, however, it appears that bedding was continually provided and added frequently, though it probably varied whether it was completely replaced with each new addition, or if it was done periodically, and deep bedding was allowed to form.
Goats

Goats were undoubtedly critical to the Roman economy and lifestyle. The wild goat is native to Italy, still numerous in our authors’ era. The ability of its domestic cousins to browse in areas unsuitable for cattle and sheep would have made it a desirable animal to keep for a large number of farmers. Goats contributed to the farm through their meat, the use of their hair and skin for making clothes and sacks, and—judging from ancient works of art—their ability to perform light draft work such as pulling carts. Most importantly however was their dairy contribution, both fresh milk and cheese. Given that a well treated doe furnishes significantly more milk than a ewe, and cattle were primarily raised for work and meat, we might expect that goat milk supplied the bulk of dairy products in many regions. Moreover, K.D. White states that goat milk was in fact the preferred milk, and most ancient depictions of goats come at the milking stand. However, the literary sources do not align seamlessly with this account: more attention is paid to sheep, and certain instructions for raising goats are simply references to the same for sheep. Sheep of course were also valued for their wool, but it still seems from much of the literature that goats were considered the lesser of the animals, even if in reality they were providing valuable milk on many farms.

While Cato mentions goats, only a shepherd specifically for sheep is noted as necessary in his farm labor requirements. Moreover, Varro asserts that the Roman people come from pastores. This term generally means shepherds and is most strongly associated with keepers of sheep, though it can also refer to herdsmen for multiple animals. Part of the reason for the elevation of sheep and the implicit
degradation of goats in the literary attitude—despite, in all likelihood, their essential contribution to dairy from the earliest Roman days—might be their negative associations with another ancient staple: the vine. Varro and Vergil report this sacrifice: “so it was that he-goats were offered to Father Bacchus, the discoverer of the vine, so that they might pay with their lives for the injuries they do him.”\textsuperscript{238} He furthermore reports that early laws forbade the grazing of goat herds in orchards. Additionally, it was common in a lease agreement for a farm that the renter was forbidden to pasture goats because of the damage they inflict on young sapling growth, such as vines.\textsuperscript{239}

Goats were looked after by the \textit{magister pecoris}, master of the flock, or a \textit{pastor}, shepherd, ideally a hardy, bold, active person capable of making his way through tough terrain and wilderness. Unlike was the case with many other animals, the \textit{magister pecoris} did not follow behind, but rather led the goats to new browsing areas. Columella reports that an energetic doe would usually head the flock, and it was the job of the goatherd to keep her back, discouraging too rapid movement so she would not lose weight.\textsuperscript{240}

\textbf{Housing}

The scope of built housing for goats is not well described in the literature, likely because there were a wide variety of functional practices. Goats, while needing shelter, are not particularly demanding in this regard, and many farmers probably got by with three sided sheds for relatively small herds. Cato for instance, refers to ox stalls and sheep pens but gives no name or reference to a goat enclosure, though he
Varro recommends a herd no larger than fifty goats and having multiple herds and herdsmen if more goats are desired; Columella allows that one hundred goats may be kept in the same enclosure. There were however two basics agreed upon: the goat enclosure should face the winter sunrise, because—while they can be affected by heat and cold—the latter is more pressing of an issue; and there should be a stone or tile floor in the enclosure, natural or artificial, to prevent the build-up of mud. Beyond this, not much is known about the layout of the enclosure or the area in which the does were milked beyond a short reference in Columella to shackling during milking time, a practice probably not dissimilar to the stanchions used today which prevent the doe from wandering off should she finish her feed or otherwise become disinterested during milking.

The authors clearly wanted to prevent moisture from accruing in the house, but the means are not completely agreed upon. The issue of bedding is unclear: Columella recommends that the pastor sweep out the dung daily, making sure no moisture remains, though provide no litter; Varro also emphasizes preventing mud and moisture, though he mentions a situation in which twig bedding was provided. This latter case occurs foris cum est pernoctandum, when they must spend the night outdoors. This is a confusing statement, as Varro does not give us more context. We might think of two explanations. First, that it refers to a situation in which the farm does not have a covered enclosure for goats, but rather walls to hold them in; bedding is provided, because—particularly exposed to the elements without a roof—it was the best way to ensure lack of moisture. Second, it could refer to situations in which the pastor had led the herd far from home in search of decent browse, and a
makehift enclosure was put up for the night. The first of these possibilities is unlikely, as goats, at least as we know them today, are not fond of the rain and should be provided with a roof. The second presents some problems as well, as there is no further account about what sort of makeshift structure should be made in these situations, and it is hard to imagine—though not inconceivable—that the magister pecoris would construct substantial temporary shelters for herds of fifty or more (however, this seems to be the case for sheep, so maybe so).

Regardless, the majority of a goat’s day was spent outside browsing in its herd. It is clear that Romans preferred to keep goats on bushy hillsides or semi-wooded areas, rather than meadows. Columella’s forage recommendations make sense in light of goats’ nature as browsers rather than grazers: thickets, brambles, briers, bushes, and shrubs. He specifically refers to ash trees, the wild strawberry tree (arbutus), Italian buckthorn (alaternus), cystisus, and young oaks.  

Feed

While goats do not need pristine pastures to cover their nutritional needs, they do have sensitive digestive systems. Especially in milking does, planned grazing and adequate supplements are critical for production. Grass, weeds, brush, and hay make up the majority of the modern goat’s diet, with many dairies feeding grain or alfalfa pellets on the milking stand as well. We know many of these foods also made up the basis of the Roman feeding program as well. However, the lack of extensive feed instruction is curious, especially considering that this information is not lacking for cattle or sheep.
The majority of the herd’s feed of course was whatever they could forage for themselves wherever the pastor led them. Because there were no permanent pastures and goats could be destructive to farm crops, they would have been led through different lightly wooded areas depending on the season, sometimes—as we can imagine—quite a distance from the villa. While our authors certainly recognize that goats prefer brushier areas than sheep, their frequent references to treating the two species similarly casts into doubt how much attention they really gave to meeting goats’ specific dietary needs. Varro states that the care of this animal in the matter of feeding is about the same as that of the sheep, though each has certain particularities: the goat prefers wooded glades to meadows, as it eats eagerly field bushes and the undergrowth on cultivated land. The system of a goatherd leading his animals through different areas resembles—without the fencing—rotational grazing today. Moving the goats around frequently through appropriate areas, as a good pastor was apt to do, would have ensured sufficient nutrition.

We are still left with questions about milking supplements and winter feed however. There are no references to giving does any supplemental grain or other feed during milking time. Because of the nutritional demands of providing milk, if this was indeed the case, we can infer that does were not milking to their potential. While cytisus is mentioned as beneficial to goats, it is stated to increase milk production in sheep, though not explicitly in goats. Winter feed is almost equally as obscure. We might expect hay to make up the majority of winter feed for goats in areas that did not support substantial winter growth. Yet, the instructions for hay harvesting make reference only to its quality for cattle, not for goats. Columella, however, seems to
present nuts as an alternative, as they are for swine. In discussing causes of miscarriage, he states that if glans (acorns, nuts) are given citra satietatem (less than is sufficient), there can be an abortion. Therefore, goats should not be fed acorns unless the feed is affatim, enough. This is odd because we might expect that, since sharp dietary changes are often the cause of health problems in ruminants, actually feeding too many nuts would be the concern, rather than too little, or at least switching them onto nuts too quickly from other feed. This however does not appear to be what Columella is suggesting: rather, he is concerned about too little mast. Such a concern might imply that it was a significant food source for gestating does, and by extension, a significant winter food, as this was the gestation season. Certainly feed other than grasses and hay, such as root crops, can make up a significant portion of the ‘roughage’ a goat needs, and the animals are certainly capable of eating nuts, yet it is uncertain to what extent they could rely on them, or even how much Columella was really advocating feeding. It is possible, especially given the lack of mention of feeding grain, nuts were a sort of grain ‘replacement’, as they were for swine.

While the issue of milking supplements for does is unclear, there are more references to supplements for kids. Columella states that, in addition to their mother’s milk, kids need elm seed, cytisus, ivy, or the tops of mastic and other foliage. Palladius likewise advocates giving ivy and the tips of arbutus and mastic. According to Varro, kids were first turned out and grazed with the rest of the flock at three months of age.
Breeding

Discussions of breeding goats in the ancient texts do not have the same curious brevity that the sections on feeding do. Varro and Columella both wisely

<table>
<thead>
<tr>
<th>Author</th>
<th>Body</th>
<th>Hair</th>
<th>Wattles</th>
<th>Horns</th>
<th>Udder</th>
<th>Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>large, strong</td>
<td>smooth thick coat; soft white hair (buck)</td>
<td>more fertile if present</td>
<td>large</td>
<td>short shoulders and neck; long throat (buck)</td>
<td></td>
</tr>
<tr>
<td>Pliny</td>
<td></td>
<td>desirable in does</td>
<td>remove for better breeding, more milk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Columella</td>
<td>large, thick legs</td>
<td>black, thick, glossy, long</td>
<td>desirable in bucks</td>
<td>doe horned if stormy climate; dehorned if not; buck always dehorned</td>
<td>large</td>
<td>short full neck, drooping ears, small head</td>
</tr>
<tr>
<td>Palladius</td>
<td>large, stout legs</td>
<td>glossy, thick, long</td>
<td>desirable in bucks</td>
<td></td>
<td>large</td>
<td>small; short full neck, heavy floppy ears</td>
</tr>
<tr>
<td>Belanger &amp; Bredesen, Storey's Guide to Raising Dairy Goats (2010)</td>
<td>square set of legs; wide ribs; broad chest; nearly straight back; large barrel</td>
<td>thin, soft, loose skin</td>
<td>merely ornaments; can remove</td>
<td>get naturally polled goats or disbud</td>
<td>avoid abnormalities; udder size not critical</td>
<td>somewhat long; concave or straight bridge to nose; bright eyes; ears pointing forward; large nostrils; large windpipe</td>
</tr>
</tbody>
</table>
recommend that a herd should be started not by buying goats from a variety of sources, but from a single flock so that the animals are already used to each other. Just as importantly, this would stop herds from spreading diseases between each other. The purchase formula for goats stated: “do you guarantee that the said goats are today in good condition and able to drink, and that the title is in proper form?”

Recommendations for the ideal conformation of a breeding goat are for the most part similar between authors. The unanimous fixation with the importance of wattles is odd, considering modern authorities consider them either unimportant or annoying. Columella gives no stated reason for the interesting advice to keep does horned in a stormy climate. There are also no instructions given for removing horns, so it is unclear whether goats were disbudded (burning the horn buds shortly after birth to prevent growth at all – more recommended by modern authorities) or dehorned (sawing off already horned goats).

Goats were bred in the fall, usually November, for a spring delivery after the five month gestation period. Curiously, there actually seems to be some confusion about the length of the gestation period. Domestic goats, as we know them, have a five month pregnancy. Varro suggests this in his general discussion of farm animal breeding: *equa enim ventrem fert duodecim menses, vacca decem, ovis et capra quinos, sus quattor* (for a mare carries a belly twelve months, the cow ten [it’s actually closer to nine, at least today], the sheep and doe five, the pig four). He states later however that a doe gives birth after the fourth month: *quaes conceptit, post quartum mensem reddit tempore verno* (the female who has conceived, delivers after the fourth month in the spring time). Likewise, Pliny both states that a doe carries
her offspring for five months, and, a few lines later, that a doe bred in November will give birth in March, four months later.\textsuperscript{262}

While it was noted that a doe could give birth to as many as four kids, twins or sometimes triplets were desired, as they are on many farms today, to ensure sufficient milk supply for each.\textsuperscript{263} It was considered a failure if two does only bore three kids between them.\textsuperscript{264} The authors give slightly different ages for when a goat was capable of breeding, generally much later than modern standards.\textsuperscript{265}

<table>
<thead>
<tr>
<th>Author</th>
<th>Doe</th>
<th>Buck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>one for each ten does, some go as high as per twenty does</td>
<td></td>
</tr>
<tr>
<td>Pliny</td>
<td>sometimes yearling; always second year, but best in third</td>
<td>most useful between three and seven years of age; can impregnate at six months</td>
</tr>
<tr>
<td>Columella</td>
<td>does can bear earlier, but should not raise kids until three years old; do not keep after eight</td>
<td>can breed at seven months; unfit at five</td>
</tr>
<tr>
<td>Palladius</td>
<td>most capable at three years old; do not keep after eight</td>
<td>can breed before one year, not after six</td>
</tr>
<tr>
<td>Niemann, \textit{Raising Goats Naturally} (2013)</td>
<td>sixty to seventy percent of adult weight (between seven and eighteen months)</td>
<td>best to wait until at least six to eight months old</td>
</tr>
</tbody>
</table>

The most striking part of the Roman program is the suggestion not to let a doe raise her young until she is three and is giving birth for the third time. Columella suggests that a first time mother should be immediately deprived of her offspring, and that a two year old mother should only stay with the kid until it is ready to be sold.\textsuperscript{266}

It is unclear what exactly, in the former case, he proposes to do with the kid. Removing kids from their mothers after birth is of course a common practice in commercial dairies, which feed the kids on artificial milk, but in Columella there is no mention of providing the kid with another milk source, nor does he give
slaughtering instructions. It is possible these kids were killed immediately and used as the rennet source for the cheese making operation. Palladius however states that the offspring of does less than three years of age should be sold. Furthermore, Columella suggests that of each pair of twin kids, one should be reserved to augment the flock and the other ultimately sold.

Kids were not weaned at less than three months of age. While there are successful operations that never wean at all today, but rather milk once a day, three months is a fairly conservative age by most standards. Belanger & Bredesen suggest weaning by weight at two and a half times birth weight, around eight weeks of age.

Health

The sources share a sentiment that goats are never truly healthy, and moreover are prone to sudden and unexpected collapse of the herd. Varro begins his discussion of this topic: *quid dicam de earum sanitate, quae numquam sunt sanae?* (what could I say about the health of these, who never are healthy?). He reports that no man in his right mind would ever guarantee that a goat is without fever and fully sound. Instead, while bargaining someone might say: “do you guarantee that the said goats (which are never free of fever) are sound of body?” Furthermore, he laments that they frequently injure each other with their horns while fighting - a problem which, seemingly unbeknownst to Varro, could be solved by taking the advice of his successors and disbudding. Though Varro suggests that the *magister pecoris* should have written remedies on hand for goats, he does not enumerate them himself. Multiple sources mention the clipping of hair, though this could only refer
to breeds which were kept for fiber as well. While clipping is a good idea if a goat has lice, it is not necessary, and it is unclear whether it was done across the board in ancient Italy.

The Roman views on goat health are somewhat surprising. It is possible that Varro and the other authors did not have a good grasp on what actually constituted a healthy goat, and they were interpreting health as fever. Yet, this would not explain the occurrence of the somewhat common herd collapse that they describe. Though it cannot be known with certainty, lack of attention paid to proper pasture management and feed, particularly during transition times from summer pasture to winter feed, and vice versa, could help explain why such collapses might have been occurring. In cases where a few animals appeared to be sick, it was recommended that the whole herd be shut up without food for four hours in the middle of the day, bled, and given no food in an attempt to prevent the whole herd from falling ill. They were also given a drink of pounded roots of reed and alba spina—literally, white root, Forster and Heffner call it crataegus oxyacanthus—mixed with rain water. Should this not work, it was suggested that all the animals be sold, or, should that not be an option, slaughtered and salted. If the goats were sold to other farmers, rather than to the butcher, this would have spread an infectious disease and would explain the frequency of the event. When the flock had to be sold, it was recommended that two seasons (fall to spring, for instance) pass before a new flock was acquired.

In the case of an isolated illness, the authors only state to apply the same remedies as for sheep. The one specific case mentioned is edema, swelling when there is a release of fluid into tissue. In this case it was recommended that a slight
incision be made, inducing flow. The wound was then treated with liquid pitch. Since edema is more a symptom of an underlying condition, we might think that this usually did not improve health. A final suggestion concerns delivery: when a doe’s genitals swelled after giving birth, a *sextarius* (roughly half a gallon) of boiled must, or wine if it was not available, was poured down the throat and the genitals were covered with wax.\(^{277}\)

Despite this view of goats as unhealthy animals, their products were used in medical contexts. Pliny states that there are thousands of remedies derived from goat parts.\(^{278}\) For instance, goat blood and marrow was used to treat dysentery, and either roasted doe liver or buck liver boiled in wine for coeliac.\(^{279}\)

**Cheesemaking**

Though goats provided meat and fiber, their dairy products were central to their relationship with the ancient Romans. Cheesemaking activity was most important on farms distant from substantial markets, as it rendered the milk less perishable.\(^{280}\) Cheesemaking can certainly be a high art, a craft which takes a lifetime to perfect. However, in its most basic sense, making cheese involves condensing milk into a solid form by removing much of the milk’s water content, the whey. Different cultures have removed whey in different proportions resulting in softer and harder cheeses, and we can assume that a wide variety of practices in cheeses existed in the Roman world as well, affected moreover by the specific feeding and climactic conditions on each farm and the resulting changes in the goats’ milk. The basics of
Cheesemaking would have varied region by region and farm by farm: different cultures, coagulants, temperature treatments, salting and spicing, and aging.\textsuperscript{281}

Columella, of the extant agricultural authors, writes most extensively on the process of making cheese from goat milk. It was recommended that cheese be made out of the freshest possible milk. The most common rennet was animal derived from the stomachs of kids or lambs, though the Romans recognized several plant derived rennets: the flower of the wild thistle (\emph{agrestis cardui flore}), seeds of safflower, green pine cones, or the liquid flow of a cut fig tree. Fresh milk was warmed near a source of heat, though not directly over flame while curdling. When thickened, it was transferred to wicker baskets or molds. Some producers would have chosen to place weights on their cheese at this point to press the whey out. It was then salted, allowed to harden, pressed again, salted again, and again pressed. Columella stresses that this should all occur in a shady spot. After nine days of this salting and pressing sequence, the cheese was washed with water and placed in rows to age. Other tips from Columella include:

1. The cheese will be full of holes if it is not pressed well enough.

2. The cheese will be dry if exposed to the sun.

3. Herbs such as thyme can be added during the curdling for flavor.

4. Cheese can be hardened in brine and smoked in apple wood for color and flavor.\textsuperscript{282}
Manure

Any farm with goats would have had a fresh supply of manure which the goatherd swept out of their housing daily in the no-bedding system. Goat manure was considered useful, and references go as far back as Cato, who advises that it be saved carefully. Varro, speaking through the character Cassius, ranks it behind bird and human manure in the third tier of quality, along with sheep and donkey manure. Palladius considers it equal with cow manure and sheep dung, less important than donkey manure, but more useful than pig. While goat manure was used on field crops, it is mostly mentioned as a fertilizer for the groves. Recommendations include forking it into plantings of cypress, using it as a paste for injuries to vines, and applying it to olive trees every three years. Columella recommends applying six pounds of goat dung to olive trees in the fall by thoroughly mixing it in to the earth.
Pigs

While shepherds and vineyards may dominate the historical imagination of ancient Mediterranean farming, the pig was a central animal, valued for its adaptability, meat, and role in religion. Though our sources make explicit preferences for other pursuits—Cato waxes poetic about oxen, Varro glows over his aviary—the importance of swine was not lost on them. In fact, Varro devotes more space in his text to pigs than any other animal. He states: “who of our people cultivates a farm without keeping swine? And who has not heard that our fathers called him lazy and extravagant who hung in his larder a flitch of bacon which he had purchased from the butcher rather than got from his own farm?” We have ample reason to believe that pork was a crucial staple in both urban and rural communities. It is not only the most common meat dish in *De Re Coquinaria* (On the Culinary Art), a cookbook attributed to Apicius, but also used extensively in religious rites and in welfare programs: the emperor Aurelian issued five pounds of pork monthly to the plebian class.

Though the wild boar captured the Roman artistic imagination more, domestic swine appears as early in Roman identity and mythology as Aeneas, the ancestral founder of the Roman race: the sow of Aeneas bore thirty white pigs at Lavinium, an omen which was fulfilled thirty years later when the city of Alba (meaning “white”) was founded. Varro reports that to his own day bronze images of these pigs were publicly displayed, and priests kept the body of a sow brined, representing the sow of Aeneas. Pigs were also a common religious sacrifice, likely going back to the early days of Rome. Cato, though he presents no organized and thorough account of swine raising, gives us this prayer offered during a pork sacrifice at a grove thinning:
Whether thou be god or goddess to whom this grove is dedicated, as it is thy right to receive a sacrifice of a pig for the thinning of this sacred grove, and to this intent, whether I or one at my bidding do it, may it be rightly done. To this end, in offering this pig to thee I humbly beg that thou wilt be gracious and merciful to me, to my house and household, and to my children. Wilt thou deign to receive this pig which I offer thee to this end.292

Another farm ritual was the *porca praecidanea*, the sacrifice of a sow to Ceres before field crop harvest.293 In addition, most state sponsored sacrificial pigs would have come from farms, rather than hunts, further incentivizing production.294

Pigs were raised by a swineherd, the *porculator*. Cato states that there should be one swineherd in a two-hundred forty *iugera* farm (roughly one hundred fifty acres).295 This person could be responsible for more than one hundred sows (in which case he would have helpers).296 Columella recommends that the *porculator* be watchful, energetic, painstaking, and active; his most important job was to make sure each litter of pigs was only with their own mother. He was furthermore responsible for recognizing farrowing sows and shutting them up, taking the animals to and from pasture, and ensuring the health of the litters, including not letting them be crushed in their sties by the sow.297

**Housing**

Raising swine in the forest was likely a common practice from early Roman history through the Empire, and for most of the year a farm’s herd would have spent the majority of its time on its marginal areas: in marshes, thick brush, and woodland. Though they were considered to prefer marsh, pigs were also seen as highly adaptable to different regions and landscapes, able to put on weight in mountainous terrain or meadow.298 The scope of built housing would of course have depended on whether
the farm kept swine for its own consumption or was trying to turn a profit on the animals. Structures functioned as farrowing quarters, though pigs were also kept in the sties at night and over the winter (to avoid letting them make a mess of meadows, as swine tends to do during the winter). The *porculator* drove the herd daily from their quarters to pasture during the warmer months, seeking marshy fields, fruit tree laden woodland, grass, and reeds.\(^{299}\)

Rows of sties under colonnades housed each sow and her litter separately.\(^{300}\) During pregnancy it was stressed that the sows not lay on each other, causing miscarriage.\(^{301}\) It is unclear whether sows were kept apart during the winter months before conception, though we can reasonably guess they were since the infrastructure was there regardless. Housing for boars is not mentioned at all, but they were likely housed in sties as well to avoid having them get lost and revert to a feral state in the forest. Sties were built with an open top so that the *porculator* could look in, count, and rescue any pigs which were being crushed by a careless mother. Varro recommends that the sty be three feet high and more than three wide, while Columella advises four feet high.\(^{302}\) Each sty had a door as well as a threshold high enough (Varro says one and a third feet) that the sow could exit, but her offspring—while young—could not. This prevented any pigs from escaping and mixing up with other litters, causing a sow to have to raise more than she birthed.\(^{303}\) Sties were cleaned by the *porculator*, who was instructed to sweep out manure and throw sand down to soak up moisture.\(^{304}\)
Feed

To a large extent (with the exception of farrowing sows), pigs were left to their own devices foraging nuts, fruits, and grasses. Each farm would have fed their swine differently however, depending on what sort of excess the villa produced: a grain farm might have more barley to spare, a produce farm could feed spoiled vegetables, a vineyard could feed dregs, and a dairy might have excess milk (Cato

<table>
<thead>
<tr>
<th>Author</th>
<th>Nuts</th>
<th>Fruit</th>
<th>Grain/Legume</th>
<th>Dairy</th>
<th>Herbage</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cato</td>
<td></td>
<td></td>
<td></td>
<td>whey</td>
<td>(10 sheep per hog)</td>
<td></td>
</tr>
<tr>
<td>Varro</td>
<td>acorns, other nuts</td>
<td>beans, barley,</td>
<td>beans, other</td>
<td></td>
<td>thrush manure; wine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(primary feed)</td>
<td>other grains</td>
<td>grains</td>
<td></td>
<td>dregs and grape skins</td>
<td></td>
</tr>
<tr>
<td>Vergil</td>
<td>acorns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Columella</td>
<td>oak, beech; stored</td>
<td>wild fruits,</td>
<td>beans, other</td>
<td>roots of</td>
<td>roots of aquatic plants; grass in</td>
<td>worms</td>
</tr>
<tr>
<td></td>
<td>acorns</td>
<td>apples, plums,</td>
<td>legumes and stubble</td>
<td>aquatic</td>
<td>cultivated orchards</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>pears, figs</td>
<td></td>
<td>plants;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pliny</td>
<td></td>
<td></td>
<td></td>
<td>grass in</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>cultivated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>orchards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palladius</td>
<td>winter acorns and</td>
<td>wild fruit</td>
<td></td>
<td>roots of</td>
<td>roots of reeds; grass in cultivated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>chestnuts</td>
<td></td>
<td></td>
<td>reeds;</td>
<td>orchards</td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>garden excess</td>
<td></td>
<td></td>
<td>pasture,</td>
<td>pasture, brassicas, hay</td>
<td>vegetables</td>
</tr>
<tr>
<td>Mountain Farm</td>
<td></td>
<td></td>
<td></td>
<td>brassicas,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2016)</td>
<td></td>
<td></td>
<td></td>
<td>hay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelly Klober,</td>
<td>corn, sorghum, wheat,</td>
<td></td>
<td>whey</td>
<td></td>
<td>pasture, brassicas</td>
<td></td>
</tr>
<tr>
<td>Dirt Hog (2007)</td>
<td>soybean oil</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
refers to *porcos serarios*, whey fed hogs, stating that every ten sheep can provide for one.\(^305\) Pigs’ adaptability in this respect would have made them a staple of Roman farms. Roman hog fattening differed from modern practices in the relative unimportance of grain and the high degree of reliance on nuts, which were consumed both directly by the pigs in summer foraging and also as a saved winter crop.\(^306\)

Roman authors mention a variety of feeds, some more familiar than others to modern swine raisers, though differing from even those few operations that practice ‘forested’ or ‘pastured’ pork today: Sugar Mountain Farm, an excellent pastured pig operation in Vermont which does not buy commercial grain, relies upon dairy and hay to supplement forage, whereas Varro states that pigs actively avoid hay.\(^307\)

Throughout the summer and fall, the ideal feeding grounds were mixed stands of forest and pasture, with fruit and nut trees ripening at various times to provide continuous sources of forage.\(^308\) The winter would have seen the granary tapped into, though not only beans and barley, but (even primarily) nuts. Columella recommends that the farmer store acorns in cisterns of water or smoky lofts.\(^309\) In the spring it was considered advisable not to let pigs gorge themselves on fresh, juicy shoots—since it would irritate their stomachs—but rather to temper their appetites by providing a morning meal before pasturage.\(^310\) This concept seems similar to the care necessary in cold climates to transition sheep and other ruminants from winter hay to fresh spring pasture, allowing limited but expanding access. It also suggests that, while available, Roman farmers expected their swine to forage for the majority of their diet. However, in order to ease the transition from winter nuts, grain, and various other refuse, those foods would have been provided in decreasing amounts through the early spring.
while the pigs were becoming accustomed to succulent greens again. The authors recognize pigs’ fondness for water, and they recommend that—unlike sheep and goats which were taken to stream twice daily—pigs, at least during the summer, spend the majority of their day around water so that they can cool themselves. If the farm did not naturally have such a spot, large troughs were filled with well water.\textsuperscript{311}

The feeding regimen for sows was more substantial, so that they could provide enough milk for their offspring. Varro recommends feeding two pounds of soaked barley daily, and doubling that if no other food is available. For better access, the \textit{porculator} was advised to spread the grain in a long line, rather than heaping it and allowing the aggressive sows to take more than their share.\textsuperscript{312} This amount is astoundingly low compared to modern suggestions for feeding a lactating sow: Klober recommends giving a nursing sow a three or four pound base and an additional one pound for each of her offspring, usually totaling twelve pounds for a four hundred pound sow.\textsuperscript{313} Especially since the feed Klober recommends is more balanced than straight barley, he is recommending over three times the nutrition that Varro does. A few explanations can be offered for this:

1. Roman sows were significantly underfed. This claim is supported by the remark that sows will sometimes eat their own young, as they are unable to endure hunger, as well as the emphasis in the literature that sows are not capable of supporting a large litter.\textsuperscript{314}

2. Roman sows consumed an impressive amount of forage, even while lactating and spending much time nursing. Furthermore, the \textit{porculator} provided nuts and other foods in substantial amounts, avoiding—likely out of necessity—the
massive amount of grain needed to keep up to one hundred lactating sows healthy.

3. Roman breeds did not have the same requirements for high amounts of grain, or overall calories.

Some mix of these three options is most likely. If a sow was running low on milk, grain (toasted wheat or soaked barley) was also fed to her pigs up to three months of age.315

**Breeding**

The Romans recognized distinct breeds of swine, basing the concept on appearance, litter size, and locality.316 Columella states that, like all other quadrupeds, the male matters more for the development of the breed as offspring more resembles the boar.317 While it is of course not true that the male contributes more genetic material to the offspring, it is in a sense true that the boar is more crucial to the overall development of the herd since one boar—in the Roman scheme—serviced ten sows; for any ten litters of offspring, the boar is fifty percent while any individual

<table>
<thead>
<tr>
<th>Author</th>
<th>Body</th>
<th>Head</th>
<th>Limbs</th>
<th>Color</th>
<th>Teats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>long, well developed shoulders</td>
<td>small</td>
<td>heavy, except feet and head</td>
<td>uniform</td>
<td>as many as she has offspring</td>
</tr>
<tr>
<td>Columella</td>
<td>large, square (rather than long), hanging belly, long neck</td>
<td>short snout</td>
<td>huge (except legs and hoofs)</td>
<td>dense black if cold; smooth white if temperate</td>
<td></td>
</tr>
<tr>
<td>Pliny</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>twelve</td>
</tr>
<tr>
<td>Palladius</td>
<td>large, not long; large belly, thick neck</td>
<td>short snout</td>
<td></td>
<td>dense black coat for cold regions</td>
<td></td>
</tr>
</tbody>
</table>
sow only contributes to her own litter.\textsuperscript{318} Preferred breeding characteristics are not extensive.\textsuperscript{319}

The process for breeding may be summarized as follows: between the beginning of the west wind and the vernal equinox (February-March), boars—which had been separated for the two previous months—were put in with the sows, ten sows to the boar (a reasonable ratio in light of modern suggestions).\textsuperscript{320} Preferably, they were driven to muddy places for a comfortable breeding environment.\textsuperscript{321} Once the sows conceived, the boars were again removed.\textsuperscript{322} Pliny advises that sows are not as prone to miscarriage if they are not allowed to conceive during their first heat.\textsuperscript{323} After the four month gestation period, each sow farrowed in her own sty (and it was made certain she was only nursing her own pigs). Her food was increased at this time, and she was given ample water twice a day to provide milk.\textsuperscript{324} Each sow stayed in the sty for the first ten days, after which she was allowed to go out daily to forage before coming back to nurse. Her offspring were also allowed to forage at this time, though they were periodically separated from their mother at this time to begin the weaning process, which was not completed until two months had passed. Varro suggests that during this time, experienced breeders would remove half of the offspring (four of the hoped-for eight), so that the sow did not become too thin and the pigs could gain substantial weight.\textsuperscript{325} It is unclear what exactly Varro proposes to do with the removed offspring, though—based on Palladius’s suggestion to free up mothers by selling feeder pigs—we can guess that is what was happening.\textsuperscript{326} Likewise, Columella also advises of the possibility that—especially for a suburban farm—offspring could be sold as feeder pigs to free up the mother.\textsuperscript{327} Such removal of
offspring for sale could help to explain the apparent scarcity of grain fed to the nursing sow. The authors’ recommendations for the ideal litter size vary:

Varro: 8 (half removed)

Columella: no more than 8

Pliny: capable of up to 20, but cannot handle that many

Palladius: 6

With the recommended early spring breeding, the litter was produced during the summer when there was ample vegetative growth for milk production in the sow, and plenty of fallen nuts and fruits for fattening the offspring in the fall. The message for a second annual litter is mixed: while multiple authors recommend farrowing twice yearly—a four month gestation followed by two months of nursing (repeated)—they warn that winter born offspring will grow thin. Likely, some farms bred twice a year, and some only once. The ideal ages at which to breed sows and boars also differed by author:

<table>
<thead>
<tr>
<th></th>
<th>Varro</th>
<th>Columella</th>
<th>Pliny</th>
<th>Palladius</th>
<th>Klober, Dirt Hog (2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sow</td>
<td>no less than one year, better twenty months up to seven years</td>
<td>one year old to seven years old</td>
<td>seven months (or in some places three!) through the eighth year</td>
<td>one year old through seven years old</td>
<td>eight months (starts cycling at six)</td>
</tr>
<tr>
<td>Boar</td>
<td>eight months to three years</td>
<td>one year old through four years old (though capable at six months)</td>
<td>not over three years</td>
<td>one year old through four years old</td>
<td>eight months (unless overmatched physically)</td>
</tr>
</tbody>
</table>

Compared to modern standards, Romans were slightly conservative with their beginning breeding ages for sows and boars, and cut the breeding life short on the
back end. The late starting breeding age may be explained in part by the relatively limited feeding. Pliny is the only author who suggests breeding a sow less than one year, and his authority is called into question by his statement that some can begin at as early as three months, since this is not true and is likely one of the fantastical stories he enjoys reporting.

Our authors recommend castrating boars during the spring or autumn: Varro at between six months and one year, and Columella at either six months (before they become capable of breeding), or at three or four years (when their years of service were over). The preferred method was making two incisions and pushing out the testicles at the same time, then smearing the wound with ash and litharge. Alternatively, one incision was made with a knife, removing one testicle, then a lancet was inserted through the wound and an inserted finger pulled out the other testicle. Columella states that the latter method causes only one scar, though is more dangerous. He also mentions a procedure for females in which a knife cut caused scarring over of a sow, though he does not give a reason why this is done (other than lack of food), nor does he recommend it. These recommendations give a much later time frame for castration than is typical of modern practices, in which it is still widely employed and the procedure can be administered as early as the first week of life. Klober states: “for market hogs, the sooner the castration procedure is performed, the less stressful it will be on the pigs.” Modern castration is often performed to restrict breeding to only selected males and out of fear of boar taint, a phenomenon unmentioned by the Romans, possibly because their husbandry practices—high reliance on forage—precluded it from developing. For the Romans, however, a
primary motivation was to increase the fat content of the animal. While the castration procedure actually slows the overall growth of the pig, it does increase the ratio of fat to muscle, of which the Romans preferred a higher one than the modern pork industry.

**Health**

The emphasis on allowing pigs to cool themselves in mud or water was an important step for herd health. Palladius states: “pigs should be pastured around streams or lakes and muddy areas in summer, or else ponds should be dug to keep mud available, since if they do not cool their plump swollen bellies frequently with mud, they suffer from the seasonal heat and contract lung disease.” However, given the diseases described, it is clear that such conditions did not always exist for pigs, and respiratory ailments occurred. Furthermore, some health issues probably arose in sows as a result of limited feeding. Columella and Palladius—who repeats many of his predecessor’s suggestions—take the most interest in veterinarian medicine for pigs. The ailments they both describe include:

1. **Lung disease**: thought to be contracted from not enough water in the summer, though more likely contracted from high stocking rates in dusty sties. Insert the root *consiligo* into the pig’s ear.

2. **Fever**: indicated by a pig holding its head sideways and eventually falling over from dizziness; treat by letting blood out of the side of the head opposite which it leans. Columella also recommends that a vein under the tail be opened with a knife after beating it with a twig, then bounding the
wound with willow or elm bark, as well as keeping any animal from which blood has been let under cover and feeding it barley flour.

3. **Nausea**: mix ivory sawdust, salt, and beans for the pig to eat before pasturing.

4. **Herd illness**: when the entire herd will not eat, keep them in a roofed area and do not allow them to eat or drink for a day; the following day, mix the ground root ecballium elaterium in water, which will cause them to vomit; afterwards, administer chickpeas or beans brined in hot water.

5. **Spleen trouble**: the condition may occur after consuming a large amount of fruit or during a drought. Make a water trough from tamarisk trunks and butcher’s broom (*tamarix* and *ruscus*); the sap from the wood will infiltrate the water and cure the condition.

6. **Struma**: swelling in the neck caused by an enlarged thyroid, usually the result of iodine deficiency, though Pliny blames it on bad drinking water; bleed under the tongue, then rub the mouth with salt and wheat; alternatively, make them swallow pickled fish through a horn, and then tie fennel stalks around their neck so that they are in contact with the swelling. Since saltwater fish are a known source of iodine, the latter suggestion almost certainly had merit.\(^{338}\)

7. **Quinsy**: administer *sideritis*, “ironwort.”\(^{339}\)
Manure

One of the responsibilities of the *porculator* was to shovel out manure from the sties and put down some sort of absorbent bedding in its place.\(^{340}\) The addition of carbon material would have helped produced a higher quality compost and improve animal health. Columella notes that pigs like a clean sleeping place and it is important for their health.\(^{341}\) Though he considers swine manure the worst for fertility, a sentiment which Palladius echoes, several authors (Columella and Palladius included) do have suggestions for its use in growing crops.\(^{342}\) Moreover, Pliny considers swine manure second best to poultry.\(^{343}\) Swine manure is the only farm dung about which our authors significantly disagree. As White points out, manure quality is affected by diet and nutrition, which varied widely in Roman pig rearing, more so than it would have for many other animals. The way each farmer would have encountered pigs with different health and diets possibly accounts for at least some of the disagreement.

Recommendations include:

1. When planting a pomegranate, quince, or apple tree, moisten the roots with swine manure.\(^{344}\)
2. Almonds will be sweeter if pig manure if applied around the roots.\(^{345}\)
3. Apple worms are repelled by swine manure mixed with human urine.\(^{346}\)
4. Pomegranate worms are repelled by swine manure mixed with donkey urine.\(^{347}\)
5. Apply diluted swine manure every five years to vines.\(^{348}\)
6. Use swine manure to mend wounds in fruit trees.\(^{349}\)
7. Use swine manure as a plaster on scorpion bites.\(^{350}\)
Poultry

CHICKENS

Of the fowl cited by Roman authors as most common, the chicken—or farmyard fowl—is most prominent. Varro tells readers that the ancients, untainted by contemporary luxurious tastes, had simply two aviaries: the barnyard in which chickens roamed, and a pigeon house. In his own time, as well as in Columella’s, a more demanding palate and taste for sumptuous feasts had created ornithones, a Greek word for large buildings which housed up to thousands of birds. Still, the keeping of hens in a free range, barnyard style would have persisted on many farms, and in all likelihood was much more common than the cramped bird houses to which our sources refer. Our earliest source, Cato, refers to birds hardly at all. He devotes only a short paragraph each to cramming chickens and pigeons, and a one line statement under the duties of the housekeeper that she must have plenty of hens and eggs. There are a few possibilities for the lack of comment from Cato: the keeping of birds was so routine throughout all of Italy that much of the requisite knowledge was assumed to be known; birds were limited to mostly a small number of hens, which provided for the villa alone in most cases, and so need not be mentioned in a treatise that aimed to show how money could be made on a farm; the keeping of chickens and other birds was considered to be squarely in the domain of women and need not be mentioned in a text whose primary audience would have been aristocratic males. This latter suggestion has echoes in Palladius’s brevity on the subject: “Any woman whose nature is at all industrious knows how to raise chickens.”
Housing

We can imagine from Cato’s (lack of) description that through the second century BCE shelter was restricted to small coops attached to the villa which housed a modest number of cocks and hens to provide eggs and meat for the household. It is likely that the birds were shut up at night, but allowed free range around the farmyard during the day with no protection from predators or limits on their mobility. This situation is also suggested by Palladius, who suggests that all bird housing should be constructed alongside the walls of the farmhouse. Varro and Columella both recommend housing for 200 chickens, the number they believed could be handled by one overseer (either a young or elderly person). It is unclear whether such a keeper would have other responsibilities. The number of birds would suggest so: a flock of 200 hens could easily be absorbed into daily chores of less than one hour total on a modern farm. Yet, the suggested ages of the caretakers, as well as their quarters—which are situated in the coop itself—imply that the gallinarius (hen-keeper) was responsible at least primarily for the hens alone. Furthermore, the ancient poultry keeper had more involved responsibilities in hatching, rearing, and disease management than the modern farmer, who relegates many of these functions to technology and medicine. Both authors suggest three connected cells to comprise the hen-house: two for the birds and one for their caretaker. These houses faced eastward, toward the rising sun. Varro’s specifications are:

- Each house 10ft long by 5ft wide by just under 10ft in height
- One woven window for each building 3ft wide and 4ft high, allowing light but not animals
- Perches sufficient to hold all 200 hens
- Nests built into the walls

An enclosed yard was situated in front of the coops, to which the birds had access during the day for sunlight and dusting. Varro suggests that a net be placed above this run to keep hawks out: the effort required to build such a net would have restricted the size of the run, essentially guaranteeing that the pen—thoroughly trodden over and picked at—was no more than barren ground, useful as a dust bath but by no means a source of forage. Varro’s recommendations yield one hundred square feet total between the two houses for 200 birds, giving each hen a half square foot of inside space each. For the modern farmer, this spacing is extraordinarily tight. We should also keep in mind that the Roman pes is a bit shorter than the English foot, corresponding to around 11.6 inches. For a backyard flock, Virginia Tech’s extension recommends 1.5 square feet, while the University of Missouri extension recommends up to 4 square feet of indoor space for each bird. The gallinarius lived between these two houses, and the walls of this room also were filled with nesting boxes, possibly alleviating the cramped conditions in the other two coops. Columella also suggests three adjacent cells, though his dimensions are larger:

- Middle cell with entrance and dimension of 7ft by 7ft by 7ft
- Two cells on either side 12ft long by 7ft wide by 12ft high
- A hearth, by which smoke can enter both cells
- Lofts in each of the two larger cells at 7ft high to accommodate roosting birds
Windows (closed nightly) at loft level for light and entrance/exit to the houses for the birds

Larger windows below the lofts of lattice-work

Nests cut into the walls with ‘porches’ in front to prevent flight directly into the nest

Stepped planks leading up to the lofts

Ladder leading up from the yard to the window entrance

Assuming the small middle house belonged to the gallinarius, Columella allows for a total of 169 square feet, or .84 square feet per bird. Though a modest improvement from Varro’s tight quarters, these coops were also very crowded.

Columella similarly suggests a covered run for the birds, which he emphasizes should be free of moisture, except in the designated lead pipe water troughs. The clausa (confined) bird always had access to a net-covered portico where it could bask in the sun. Columella explains, however, that such precautions against hawks and other predators were only sensible where a large return on poultry keeping could be acquired. We can infer that the vagis (wandering, roaming) bird was more common among farms far away from large markets or otherwise uninterested in a major poultry enterprise. These birds were not restricted during the day and would have been able to forage around the villa yard.

Feed

The Romans fed their fowl in two different ways: primarily, the maintenance ration that sustained laying hens and breeding roosters; otherwise, cramming,
whereby food was forcibly put into the gullet and the bird’s movement was highly restricted, resulting in quick growth and high fat content.

As chicks, food was withheld the first day (which is not a problem, as the absorbed yoke allows young birds to survive during this period without food or water). Afterwards, Varro suggests that chicks receive a mixture of barley meal and cress seed that has been kneaded with water, creating a product akin in texture to the commercial chick starters available today.\textsuperscript{365} Similarly, Columella’s ‘starter’ includes boiled barley or wheat flour mixed with water and sprinkled with wine.\textsuperscript{366} As mature hens, there were two feedings a day for the free ranging bird, morning and evening, and three for birds which were only allowed into the covered run. Feeds included barley, grape-husks (only when not laying, since it was believed that they cause small eggs), chickpea, millet, panic-grass, boiled darnel, and bran. Columella also recommends the leaves of the \textit{cytisus}. Free range birds were expected to forage for roughly half of their diet, as they received two \textit{cyath}i per head daily, whereas the confined bird received four.\textsuperscript{367}

Translating to U.S. measurements, a free range bird received approximately one-third cup of feed daily.\textsuperscript{368} UC Davis recommends that an adult laying hen receive between 1.8 and 2.4 pounds of feed per week, or average .3 pounds daily.\textsuperscript{369} This suggestion is for birds assumed to have no supplements (as the free range Roman chicken would), so we can compare it to the four \textit{cyathi} for Columella’s shut up chickens. Two-thirds cup of such feed as our authors listed was likely more than .3 pounds a day, though the nutrient quality may have been lower, as today’s formulated feeds rely heavily on protein dense corn and soy, which were not available to ancient
Romans. The certainty with which our authors declare that birds do not lay during the winter suggests this as well. While the lack of artificial light certainly plays a role, we would expect there to be at least modest laying from a bird receiving similar poundage to today’s recommended feeds. It is likely then that farmers more or less consigned themselves to having very few eggs in the winter and fed accordingly, switching to such protein poor feeds such as grape husks. To encourage productivity, Columella and Palladius recommend partially cooked barley seasoned with the leaves of cytisus (or, if not available, vetch or millet), and advise that pomace from wine pressing, if consumed, causes infertility.370

The majority of Cato’s short discussion of fowl is a description of cramming, showing the antiquity and cultural importance of the practice. Despite Columella’s assertion that cramming belongs to a specialized fartor, stuffer, rather than the country person, the relative attention given to the practice by our oldest source and the attention given to the matter by subsequent writers suggests the commonality of the practice on many types of farms.371 Cato recommends that this task begin as a hen is beginning to lay (a considerably older age than that at which today’s ‘race-car’ meat birds are slaughtered).372 The fattener made feed pellets of moist barley or wheat flour and pushed them into the bird’s mouth, increasing the food throughout the cramming period as the chicken became accustomed to such treatment. This process occurred twice daily, with water placed before them no more than one hour daily at noon.373 Varro explains that though the Romans fattened many birds, the chicken was the most common of these (corresponding to its general frequency). The largest birds, selected for cramming, were confined in dark, narrow spaces, feathers
pulled from their wings, head, and tail (to discourage lice), and stuffed with either barley-meal pellets—as Cato suggests—or barley mixed with darnel flour or flax seed. Some made their cages so tight that they were unable to turn around; a hole at each end was made, one for the beak to admit food, and another for the vent to expel it in the form of manure. At each of the daily feedings, the authors suggest that it should be determined that the bird has consumed the entirety of the previous feeding before proceeding with the next. While Varro recommends that lice be picked off at each feeding, Columella allows that the birds should be let out of their enclosures for a short period to peck at themselves for the same reason. While the amount of food given was normally increased daily, if the bird lost its appetite the ration was reduced. The process lasted twenty-five days, or, if wheat bread mixed with water and wine was given alternatively, twenty days. Columella adds that, if begun at the new moon, the process need only last twenty days, and should never go longer than twenty-five. Certainly this process is offensive to many contemporary sensibilities, invoking both the modern ‘battery cage’ and foie gras production, and going beyond these by restricting light as well as movement. Despite concern for well-being in several other elements of fowl raising, none of the authors question this practice on ethical grounds. In the absence of high protein feeds and single-purpose hybrid meat breeds, the only other way to produce tender meat would have been to slaughter birds at quite a young age, producing a small carcass. The cramming process allowed the Romans to produce a tender, but large sized poultry product.
Breeding

Our antiquarian Varro reports that the chicken was the first of all animals to be bred in the villa.\textsuperscript{380} The detail and strength of opinion by which the other authors describe the ideal chicken does not hurt the credence of this guess. Each of the interested writer’s preferred chicken characteristics are summarized in the following table.\textsuperscript{381} Columella also remarks on essential characteristics specific to the rooster:

<table>
<thead>
<tr>
<th></th>
<th>Plumage</th>
<th>Wing Color</th>
<th>Talons</th>
<th>Head</th>
<th>Temperament</th>
<th>Breed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>red</td>
<td>black</td>
<td>uneven</td>
<td>large</td>
<td>lustful (roosters)</td>
<td>not Tanagrian, Median, Chalcidian (fighting)</td>
</tr>
<tr>
<td>Columella</td>
<td>red or dark brown; not white</td>
<td>black</td>
<td>avoid crossing</td>
<td>large</td>
<td>lustful (roosters)</td>
<td>cross breeds; not fighting; not bantam</td>
</tr>
<tr>
<td>Pliny</td>
<td>black</td>
<td>black</td>
<td>crossing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palladius</td>
<td>black or yellow; not white</td>
<td>black or yellow; not white</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

high and straight with a blood-red crest; dark eyes; short, hooked beak; bright red wattle; broad and muscular chest; brawny wings; prominent split tails; huge thighs.\textsuperscript{382} Varro and Columella both warn against acquiring the Greek-type fighting birds, suggesting that the farmer should be more concerned with high laying capacity than the entertainment value of aggressive birds. This practice was borrowed from the Greeks, and cock fights were in Italy by the 2\textsuperscript{nd} century BC.\textsuperscript{383} Our authors’ disapproval of these events should not however be confused with a preference for roosters that were shy generally: aggressiveness toward predators was an important
characteristic for free ranging roosters, because—along with the *gallinarius*, they were the primary means of daytime defense. Columella suggests that there should be one rooster for three to five hens depending on the libido of the breed. This ratio is well under what would be necessary for fertilization alone, furthermore suggesting that roosters were an essential part of the predator protection strategy. Any roosters which did not meet the farmer’s breeding specifications but for whatever reason—most likely taste preference—had not been slaughtered yet were castrated. This process—as we understand it today—induces hormonal changes in the bird which produce a heavier carcass and fattier meat. Both Varro and Columella however give this curious method of “castration”: burn the back talon of the leg with a red-hot iron and then smear it with potter’s clay to help the sore heal. This is unlike modern caponization, in which the genitals are surgically removed from the body. It is unclear how (if at all) removal of the spur actually induced hormonal changes, or if there was simply a psychological change in the rooster. Without its weapons, the rooster may have been more docile. Despite Varro and Columella’s confident assertion that this is the way to castrate a rooster, it is still hard to see how a simple spur removal actually brought about the changes which a modern reader associates with a capon.

Reproduction was accomplished by what in contemporary terms we call natural incubation, though the process was far from hands off, as often is the case with many people who attempt this method today. Chickens were used not only for brooding their own, but also the young of other birds such as peafowl and geese. In such cases, the disparity between the number of days to hatch had to be considered, and the eggs set accordingly. To discourage development of lice or flea populations
that would disturb the hen and eggs, the process began with the *gallinarius* placing clean chaff or straw in the nesting boxes (and periodically renewing it throughout the brood), then spreading and purifying it with a torch, sulphur, and bitumen. Varro and Pliny suggest that the maximum number of eggs per hen to be set is twenty-five, and Varro maintains that the process will be most successful if it occurs between the spring and fall equinox, and begins just after the new moon. Columella, however, suggests that eggs should be set between the tenth and fifteenth day of the month so that there is a waxing moon both at set and hatch. Pliny suggests the ninth day. Colombella further adds that an odd number should always be set: fifteen at the first setting in January, nineteen in March, and twenty-one in April through to October at the last setting of the year. He notes that many people think birds hatched after the summer solstice never obtain full growth, though farmers with markets for selling pullets should disregard that advice. While many modern readers may be highly skeptical about the relevance of moon phases to the success of chicken hatches, it should be noted that widespread support for planting by the phases of the moon still exists—especially in circles of Biodynamic agriculture—such as is advocated by Stanford and Yale educated farmer John Jeavons. Obviously though, plants and eggs are not the same. Pliny and Columella both suggest that rounded eggs will hatch female birds and pointier eggs male.

By putting the eggs under old hens (which do not lay as prolifically, and were only kept until their third year of age), the younger females were free to lay for consumption. The *gallinarius* then was responsible for gathering eggs and, within ten days, placing them under a suitably aged and tempered broody hen (any hens
which were accustomed to break or consume eggs were culled immediately).\textsuperscript{393} Eggs were tested through the following methods, which are still recognized today:

1. An empty (infertile) egg floats, while a fertilized one sinks.
2. Light shines through an empty egg, while it does not for a fertilized one.
3. The eggs should not be shaken.\textsuperscript{394}

Each broody hen was shut up for the duration of the incubation, except on Varro’s account when there were periods during morning and evening when they were allowed to go out to drink and eat (Columella avoids this by placing food directly by each broody hen).\textsuperscript{395} The \textit{gallinarius} was responsible for turning the eggs every few days.\textsuperscript{396} Since broody hens are likely to turn the eggs naturally and without help, this intrusion by the caretaker represents middle ground between a completely hands off ‘natural’ method and a completely automated artificial brood. The same can be said of the decision to collect eggs and put them under specific birds: while the hen still did the work of heating, a human was making the decisions about which eggs would be hatched and which hens would have the responsibility of brooding and nursing other hen’s eggs (rather than just letting select broody hens continue their own course). Furthermore, the \textit{gallinarius} would look for emerging chicks starting on the eighteenth day and help any that were having trouble breaking through the shell.\textsuperscript{397} The day of the hatch (while the hens could not tell each other’s chicks apart), the surviving chicks of two to three hens were transferred to one designated nurse hen, with the limit for one nurse at 30, freeing up the other hen(s) for more laying.\textsuperscript{398} Rather than handling the chicks directly for the move, Columella suggests that they should be scooped up in a sieve made of vetch or darnel (an annual grass) and
fumigated with sprigs of pennyroyal to promote health. Chicks were kept shut in the house while young both for predator protection and to ensure warmth, receiving full range of freedom only after forty days (a number which is reasonable in terms of today’s artificial brooding specifications as to when a lamp may be removed).

While many of the authors’ practices seem to establish a prudent middle ground between do-nothing natural brooding and completely automated artificial brooders, there was certainly a great deal of superstition in their practices. A few of these are recorded by Pliny. He suggests that both the sound of thunder and the cry of a hawk cause eggs to go bad. He furthermore does not understand that hens will lay regardless of whether a rooster has fertilized them, noting special instances in which hens have miraculously produced eggs, fertilized by ‘the wind.’ A few of his ‘fantastic’ accounts may actually have merit, however. Two stories recount miraculous hatches of chicks without a broody hen: the first on the dunghills of Egypt, the second in the bosom of Julia Augusta, who kept eggs continuously in the folds of her clothes. Both of these stories gave rise to the notion that warmth, rather than a chicken, was needed to hatch eggs, and led to a method he records whereby eggs were placed in chaff and kept by a moderately warm fire. This method plausibly worked, and could represent the first instance of intentional artificial brooding.

Health

Several preventative poultry health measures which are still held in importance today appear to have been routinely practiced:
1. Construction of perches to allow birds to sleep elevated from their own manure.

2. Access to dust for birds to engage in their natural bathing habits.

3. Addition of clean bedding to nesting boxes.

4. Covered troughs for water, preventing manure from falling in.

This last point is especially stressed by Columella as a measure of fighting off disease.\textsuperscript{402} One particular disease, \textit{pituita}, or ‘the pip’ is given prominence in the literature. K.D. White identifies this as a disorder of the liver which causes thick mucus in the mouth and throat and a white scale on the tip of the tongue. Preventatively, Columella advises all of the above measures, as well as fumigation of the coops and removal of manure.\textsuperscript{403} White believes that Columella’s emphasis on clean water and adequate warmth and feed adequately cover the primary preventative means necessary to ward off the disease.\textsuperscript{404} While all of these most likely played an important role in maintaining a healthy flock, it also seems likely that the extremely cramped living conditions inside of the coop may have played a major role in the spread of the disease. White furthermore notes that beyond the general sanitation concerns, all of Columella’s remedies merely mask the symptoms of the disease.\textsuperscript{405}

For moderate symptoms, the author suggests\textsuperscript{406}:

1. Inserting garlic and warm oil into the bird’s throat.

2. Wetting the bird’s mouth with warm human urine until it expels the mucus from disgust.

3. Feeding wild grape.
Of these, the first and third may have some degree of effectiveness, especially since garlic is a known anti-bacterial agent, and the second, as White notes, is essentially masking symptoms. If symptoms became more severe (inflamed eyes and lack of appetite) it was recommended to cut the fowl’s cheeks, press out the puss, and rub salt in the wound.\textsuperscript{407} Pliny also gives significant attention to the disease, suggesting a similar remedy of garlic. He furthermore suggests:

1. Keeping the bird hungry.
2. Subjecting the bird to smoke, especially that of bay leave or savin.
3. Inserting a feather into the nostrils to remove mucus.\textsuperscript{408}

The smoke suggestion is echoed by Columella who advises as a general measure that the coop should be proximate to a kitchen or hearth.\textsuperscript{409} Other suggestions include relieving any blockage in the vent of a chick (pasty butt) and burning a stag’s horn, galbanum, or a woman’s hair to ward off snakes, whose very breath is said to kill chicks.\textsuperscript{410}

**Manure**

Chickens were valued not only for their meat and eggs, but also for the fertility they returned to the land through their high-nitrogen waste (though none of the authors regard chicken manure as the best of all). The importance of coop sanitation and keeping dung away from the talons and vents of the birds was also recognized. A few curious uses are also suggested by Pliny:

1. Hair loss through mange (a skin disease caused by parasitic mites) can be cured by application of fresh hen manure.
2. Application of hen manure as a cure for ulcers on the pupil.

3. An ointment for ‘night blindness.’

RUSTIC HEN

Despite modern inability to pinpoint the species and ancient brevity on the animal, our two most extensive sources consider these *gallinae rusticae* to be one of the three main species of fowl. Secondary literature has identified this bird as hazel-hen, heath-hen, field-hen, red-legged partridge, Italian partridge, or domestic chickens gone feral. Columella explains that the rustic hen, while quite similar to barnyard fowl, is caught in the wild by bird trappers, rather than raised domestically as the chicken. It was found primarily on the island “Gallinaria” in the Ligurian sea. Varro describes in more detail:

> Wild hens are found rarely in town and are hardly seen in Rome, except the tamed ones in cages. In appearance they are not like these barn-yard fowls of ours, but rather like the African fowl... Usually they do not produce eggs and chicks in farmsteads, but in forests. It is from these fowls that the island Gallinaria, in the Tuscan Sea off the coast of Italy opposite the Ligurian mountains, Intimilium, and Album Ingaenum, is said to have got its name.

As Columella states, since these fowl do not breed in captivity, there is little to mention about them except to feed them adequately for feasts. We can infer from these statements that a typical farm was not expected to have such fowl, and they were primarily used for cramming after being caught in select areas.
GUINEA FOWL

The third species of bird mentioned is what our authors refer to as African fowl. From their description as speckled and helmeted, we can safely infer that they are referring to what we call guineas. Today guinea fowl are often considered rustic, low-maintenance birds which provide aggressive insect control and meat. As Varro explains, however, in the first century BC they were the latest poultry fad, recently imported from Africa and designed for the “pampered” tastes of the upper crust.\(^\text{417}\) Columella’s advice is simply that raising guineas is similar to raising peafowl.\(^\text{418}\)

PEAFOWL

Though peafowl came from India, they were sacred to Juno in Roman mythology and held cultural importance in art and religion.\(^\text{419}\) Varro introduces the topic of peafowl—as often, through characters in dialogue—by remarking on their ability to return significant income to the farmer. The birds were almost certainly not common on a typical rustic farm, but rather a recent trend for urban plates and a business opportunity for aristocratic landowners. Columella remarks: “the rearing of peafowl calls for the attention of the city-dwelling householder rather than of the surly countryman.”\(^\text{420}\) Despite this statement, Columella actually describes their rearing in significant detail. They receive an amount of attention in the literature likely disproportionate to the frequency with which they were actually raised by the common farmer.\(^\text{421}\)
Housing

Unlike the shut-up bird, which only had access to a barren, netted portico, and the free range bird, which wandered at will from a centralized coop, Varro suggests that peafowl were pastured through fields, presumably led by their keeper. Yet, like the rustic hens, these fowl were associated with specific islands with large populations, on which they were able to safely wander without predation or human harassment. The pasturing scenario may have been more the case on the predator-free islands, as the high value of the birds would have provided motivation to reduce losses as much as possible. In inland districts, grass and trees were enclosed by a covered walkway and fence on three sides, with the fourth side blocked off by two huts: one for the birds and one for their keeper. Reed enclosures under the covered walkways separated each peacock and its hens from the other males to prevent quarrelling especially during feeding time. Columella advises that the peafowl house be kept free from moisture and include squared perches.

Feed

Peafowl were fed supplemental grain, and barley was recommended at one modius a month per head (roughly 2.3 U.S. gallons). This converts to about one and one fourth cups of barley per day per bird, though they were fed more generously during the breeding period. Raised in the favorable island situation, however, the keeper only had the light responsibility of gathering the flock at a fixed time daily and feeding a modest amount of barley. To encourage production during the late winter, toasted beans were given, which would have added significant protein to
Peachicks were generally fed on cereal gruel and barley meal sprinkled with wine. Cut “Tarentine” leek, soft cheese, and locusts are also mentioned as supplements added to the diet through the sixth month, after which barley alone was given.\textsuperscript{428}

**Breeding**

The suggested ratio of male to female depended on the motivation of the keeper: for financial return, it was considered prudent to have fewer males (a one to five ratio), though for the eye’s pleasure the opposite was true.\textsuperscript{429} In fact, given the exotic nature of the birds, appearance was likely a major motivation in keeping these animals. Varro asserts that the hens should not breed at less than two years of age nor when they are old, while Columella believes breeding is only best beginning at three years of age.\textsuperscript{430} They were said to be lustful February through March, in which season their enclosures were piled high with organic material to protect the eggs from breaking. Once a peahen began laying, it was shut up in its enclosure to prevent it from depositing its eggs elsewhere. Peahens are highly seasonal layers: Columella states that a peahen which is not allowed to brood its own eggs will have three laying rounds per year: five eggs at the first, then four, then three or two. Except on the last laying round of the year, it was advised that a chicken brood the peafowl eggs, releasing the mothers for laying of more valuable eggs: the largest chicken hens were chosen to sit upon nine eggs (five peafowl and four of their own) on the ninth day of the month.
Owing to the difference in incubation time, ten days into this period the keeper would switch the chicken eggs with fresh ones to facilitate hatching of the peachicks and farmyard chicks at the same time on the new moon. Especially considering the brooding hens’ small size in comparison to the peafowl eggs underneath, the keeper was responsible for turning the eggs when the opportunity arose: this was made easier by marking one side of the egg, so it could be known whether the hen turned the eggs herself. Just as in raising chickens, the newly hatched peachicks were transferred to a designated nurse hen, which was responsible for twenty-five birds. After thirty-five days, it was considered safe to take the chicks out to fields, following their designated hen nurse, which had a line attached to its leg, preventing it from wandering far. Columella also advises that the nurse hens for chicks and the ones for peachicks should not be kept together, as the former become jealous of the beauty of the latter.\footnote{Palladius, in substantial deviation from his predecessors, remarks that a much more hands off approach is suitable for peafowl, and that they are essentially capable of raising young by themselves. Since they can more or less feed themselves in the field and house themselves in trees at night, he says, the keeper’s main job is to ward off any foxes.\footnote{The more relaxed approach favored by Palladius may be in part a reflection of the decreased lucrative ness of the enterprise.}}

Health

The health of a peafowl flock was managed in the same way as for farmyard fowl, including the pip and indigestion. It was again advised that any peafowl
sleeping on the ground be made to rest on perches to avoid standing in their own
manure.\textsuperscript{433} Palladius adds that the greatest health danger for peafowl occurs when
their crest begins to grow, likening the event to a human infant teething.\textsuperscript{434}

\textbf{Manure}

Varro maintains that the manure of peafowl should be picked up because it is
not only useful as fertilizer, but also \textit{ad substramen pullorum}, litter for chicks.\textsuperscript{435} This
is a somewhat confusing statement. In light of his own and others’ advice to keep
birds off of their own dung, this statement appears to contradict general health
precepts.

\textbf{PIGEONS}

While many of Varro’s historical musings are likely highly unreliable, his
statement that the ancients commonly kept pigeons along with their chickens seems
probable.\textsuperscript{436} Their mention by multiple authors and especially the importance of their
manure in discussions of crop and vine growth—and the assumption that ordinary
farmers would have plenty of it—suggests that keeping pigeons was a widespread
practice. Though Cato hardly mentions birds at all, he does remark both on cramming
this species and spreading their manure on meadows, garden, and field, suggesting
that a substantial number of pigeons were commonly kept.\textsuperscript{437} Columella remarks
that—unlike many of the trendy birds of the time—pigeons were not so much good
for cramming, but still worthy of the common farmer to keep generally.\textsuperscript{438} Yet,
pigeons were recognized to bring a handsome profit on account of the short time
required for them to lay, hatch, and rear (producing up to eight litters a year). Moreover, they were not simply another one of the fashionable tastes in the late Republic and early Empire, but rather a common farm staple spanning from Cato through to Palladius, as well as a rooftop commonality in towns.

**Housing**

We can infer that the common rustic farm kept pigeons on the rooftop and they were allowed full freedom to come and go as they pleased. Pigeons were likely kept in this small-scale rooftop way before the exotic bird fads of Rome’s pinnacle and it appears—owing to Palladius’s description—that most farms returned to this method during the decline of the Empire. Palladius describes the pigeon cote as a high, small tower with smooth white walls on top of the farm’s main building. It had very small openings, which could only admit pigeons and faced in all directions from the cote with nesting boxes inside. There was a possibility that these ranging birds would abandon their home. Columella suggests, and Pliny reiterates, this curious preventative measure for the issue:

> For the prevention of such an escape, there is an ancient precept of Democritus. There is a kind of hawk which the country-folk call a *tinnunculus* (kestrel) and which generally makes its nest in buildings. The young of this bird are enclosed separately in earthenware pots, and while they are still breathing, lids are put over the pots which are smeared with plaster and hung up in corners of the pigeon-houses. This induces in the birds such a love for the place that they never desert it.

Pliny also suggests that the joints of pigeons’ wings can be cut with gold to achieve the same result (staying at home) without injury to the bird’s health. This is a rare ancient mention of wing clipping, which is a fairly common practice today over a
wide variety of poultry and other captive birds. Like Columella’s hawk superstition, Palladius has a few of his own: keeping rope made from the grass esparto scattered among the pigeons (as long as no one sees you put it there, he adds), hanging pieces of a strap which was used to strangle someone in each corner of the house, and hanging twigs of rue in multiple spots. Based on Palladius’s suggested feeds, we can infer that this type of home kept pigeons by the dozen, rather than by the thousand, as in the larger Roman pigeon enclosures.444

For those close to the city, allowing the birds substantial freedom could not be done as bird catchers were likely to grab pigeons, so they were held in confinement.445 Our authors describe this method, the peristeron (the Greek word for dove or pigeon cote), in greater detail. Such buildings housed up to 5,000 birds. These were large structures, lofted and facing the winter midday sun, with vaulted roofs, one door, and windows that allowed the entire interior to be light but did not admit snakes or other predators. The walls were thoroughly plastered so that mice and lizards could not enter the peristeron and disturb the birds.446 Recognizing that pigeons often pair off into long-term monogamous relationships, Varro suggests that round nests be made for each pair of pigeons (imagine having to make a couple thousand of these for the largest peristeron!). They ran side by side in rows which spanned from the floor up to the roof. The opening to the nest was large enough to allow only narrow entry and exit, with the dimensions of the space being three ‘palms’ in each direction. A board was mounted in front of each row of nests, two palms wide, so that the birds could fly onto it before entering their home.447 Similarly to chicken coops, a netted area for the pigeons for basking in the sun was provided.
Feed

The rooftop birds of most farms would have been able to provide for much of their own dietary needs, feeding on seeds and such as they roamed the farm meadows. During the leanest months, however, they would be fed some storage grain.448 Palladius suggests rooftop birds receive one *sextarius*, 2.3 cups, of wheat per each ten, as well as vetch in the winter (a protein supplement to encourage laying). This daily ration amounts to roughly a quarter cup of grain per bird, and while a modest amount, is actually more than we might expect for free ranging pigeons, especially considering Columella’s confidence in their ability to forage for themselves.449 For the birds raised for city market, troughs running along the outside of the *peristeron*, filled through pipes outside the structure, provided food to the pigeons. Feed included millet, wheat, barley, peas, kidney beans, vetch, darnel, and any wheat refuse or pulse.450

For fattening, the oldest record we have is from Cato: he begins by saying that the bird must be *prensus*, “caught” or “seized.” This could mean both that the birds were wild and caught in nets, or simply that the keeper grabbed them from the dove-cote. He suggests that the farmer feed the pigeons cooked beans by blowing them from his own mouth into the mouth of the bird, and watering in the same fashion for seven days. Afterwards, a mixture of beans and spelt was thoroughly boiled and kneaded. After rolling it in oil to make pellets, it was soaked and fed.451

Later practices are actually much less involved. With Varro and Columella’s approach, this process began earlier in the life of a pigeon than with Cato’s method: pigeons were shut up as soon as they were “covered with down feathers,” or in other
words, very shortly after birth. Chewed bread was given twice daily in winter and thrice in summer to the parents, who would in turn feed their offspring abundantly. Once their larger feathers had come in, the pigeons were left in the nest of their parents with their legs broken and particular wing feathers removed. Columella asserts that broken legs deprive the birds of hope of wandering freely, and also that the pain only last a couple days.452

**Breeding**

Varro notes three species of pigeon: the *agreste* (rustic) or, as it is sometimes called, *saxatile* (rock); a calmer, though unnamed species; and the hybrid of the two. The first of these species is described as variously colored, living in farmhouse turrets, shy of humans, and spending their time flying between the fields and their lofty abode.453 The second breed is described as a white pigeon which preferred to feed around the doorstep of the villa. These two were likely the common, ancient breeds which could be found in small villas the countryside over. The third, mixed species, was the profit bird, raised in the *peristeron*. Due to hybrid vigor, this species would have put on weight more quickly and been preferable for an intensive meat operation.454 It is unclear whether Columella also endorses this hybrid breeding practice, as he suggests that birds of different breeds feel less affection for each other and will therefore not produce as many offspring. For color, white was advised against for free ranging pigeons, owing to their conspicuousness, but irrelevant for the confined bird.455
Brooding birds were kept in their own area of the *peristeron*, which included access to the outdoors (beyond the netted portico). Unlike the other birds which were being fattened in confinement, it was acknowledged that brooding mothers could become sick from the cramped quarters: With the impending birth of their young as motivation, they were trusted to return home if they flew out for fresh air. An equal number of males and females were suggested, due to their tendency to pair off. Pliny states that pigeons are among the most modest of races, loving their offspring equally and being ignorant of adultery (though he describes the males as often suspicious of it in their partner). It was also recognized that pigeons have two offspring at a time, and Columella advises they should not be separated. Pliny asserts that a pigeon lays a male egg and then a female one the next day.

**Health**

Pigeons were recognized to prefer clean conditions, and Varro suggests that clean water be piped into the *peristeron* for drinking and bathing. Columella, however, advises that the troughs only be big enough to admit a pigeon’s neck, so they cannot enter the water and foul it. It is unclear whether Varro—who usually is cognizant of water sanitation issues—had a system which accounted for this. He suggests that any hurt pigeon be treated and dead ones be promptly removed.

**Manure**

According to Varro, a certain Cassius states that pigeon manure is the best of all, since it has the most heat and causes the earth to ferment. Columella himself
also believes pigeon manure to be superior.\textsuperscript{463} He recommends: spreading pigeon dung over newly planted vines if there is suspicion of cold weather in the region; spreading pigeon dung over a field that has just been ravaged by a plague; and putting one \textit{sextarius}, 2.3 cups, of pigeon dung on each grape vine annually.\textsuperscript{464}

Varro suggests that the keeper should sweep the house out monthly, both for the health of the birds and to use their manure as fertilizer.\textsuperscript{465} There is no mention however of putting down a carbon source such as straw or hay in the house to balance the decomposition of the dung. If the manure indeed was swept out only monthly, especially in one of the larger houses, there would have been an awful smell emitting from the house, due to the density of the manure and the high nitrogen quality specific to pigeon droppings.

TURTLE DOVES

Turtle doves were raised similarly to pigeons: an enclosure was built with a door, windows, plastered walls, and clean water access.\textsuperscript{466} Palladius placed his directly below the pigeon enclosure.\textsuperscript{467} However, unlike pigeons, which laid eggs inside of their houses, turtle doves were caught wild and did not breed at the villa. Instead of nests, there were hemp mats set on brackets lining the walls, with the first row three feet off the floor and each row above at intervals of nine inches. Nets were placed in front of the mats to prevent the birds from flying around their enclosure and losing weight.\textsuperscript{468} A half-modius of wheat was suggested for 120 turtle doves, which converts to roughly two and a half tablespoons of grain per bird daily.\textsuperscript{469} Columella especially recommends millet or, during the winter, stuffing the birds with wine.
Palladius endorses both wheat and millet, though soaked in honey water. Varro and Columella recommend that chicks be fattened at the time of harvest, when mothers are at their best and most capable of raising plentiful and healthy young. This suggests an increased grain ration as a result of the abundance of the harvest, and that the preferred age of the turtle doves for fattening coincided with this time. It was also believed that turtle doves naturally grew fatter during the summer even if the feed ration did not change.

Varro suggests their manure be swept out daily and used for fertilization. Pliny recommends the following uses for it:

1. Curing white ulcers.
2. A cure for bladder trouble when boiled in honey wine.

PHEASANTS

Though the pheasant was known to the ancient Greeks by the 5th century BC, Palladius is the only Roman agricultural author who mentions raising it. Nevertheless, his operation went beyond simply trapping the birds and fattening them as was done with turtle doves. Pheasants produced offspring once a year. For breeding, he suggests:

1. Using only birds less than two years old.
2. Breeding in March and April.
3. Having a 1:2 male to female ratio.
4. Brooding by means of chicken hens, which would set fifteen pheasant eggs and five of her own.
5. Observing the moon and dates of the month as with other birds.

For the first fifteen days of life, he suggests feeding lightly cooked barley meal sprinkled with wine. Afterwards, locusts, cracked wheat, and ant eggs were provided. He restricted water access, hoping to prevent the pip, in which case the pheasants were rubbed around the beak frequently with a mix of garlic and liquid pitch or otherwise treated in the manner of chickens with this condition. To fatten:

1. One *modius* of wheat meal, kneaded in to small pellets, given to each pheasant over thirty days (approximately one and a quarter cup of grain daily).
2. Alternatively, meal from one and a half *modii* over the same period (approximately 1.85 cups daily).
3. Sprinkle the pellets with oil and insert them down the pheasant’s throat.
4. Make sure the previous feeding is fully digested before giving another.\(^{474}\)

THRUSHES

Mention of raising *turdi*, “thrushes,” or “fieldfares,” first appears in Varro as a jumping off point to his entire discussion of bird keeping. Like turtle doves, these birds were not bred in captivity, but rather were captured and then put into houses, fattened for banquets, and looked upon for entertainment. As they naturally wintered in Italy, they could be raised in the summer for a high financial return, though that practice was considered extravagant.\(^{475}\) Varro pays significant attention to raising thrushes, and the success of his and his characters’ aviaries seems to be a point of pride and an ostentatious display of wealth. The character Merula (“blackbird”) states that Varro’s aviary at Casinum is merely for pleasure.
Varro, however, does speak of another type of aviary, which was maintained for profit. Varro boasts that his aviary sold 5,000 thrushes, bringing in a profit twice as high as the total profit from his friend Axius’s 200 iugera (approximately 140 acre) farm. This enterprise consisted of a large domed building or a peristyle covered with netting, in which thousands of small birds were enclosed. Water was brought in through pipes and spread through narrow, easily cleanable channels, with the overflow running out through a pipe so as not to muddy the enclosure. Windows were limited so that the birds could not see well outside, since he believed their longing for freedom did not allow them to grow fat. Perching poles were provided, and cakes of figs and spelt were given as food, with large quantities given beginning twenty days before slaughter. As birds were selected for slaughter, they were taken out into a smaller, separate coop so that the others could not see.476

Columella also has a chapter on thrushes, and notes a few useful suggestions, many of which Palladius echoes:

1. Keep the thrushes in the district where they are caught for the sake of their health.

2. Mix old thrushes with those recently caught as it alleviates the despair that these birds feel in confinement.477

3. Provide a variety of food so the birds do not tire of their feed, including seeds of myrtle and mastic, wild olive and ivy berries, and the fruit of the strawberry tree, as these are thrushes’ natural diet.

4. Keep troughs of millet available as the staple of the diet.478
Varro’s aviary at Casinum was quite elaborate in architecture and features, including dwarf trees, colonnades, a pond, and a ‘bird theater’; he devotes more ink to it than he does to most of the other birds he speaks of raising.479 However, as these structures were more displays of wealth and entertainment venues than standard farm operations, the details, which can be found in other secondary literature, will be omitted here.480 Pliny mentions that a thrush roasted with myrtle berries aids with dysentery.481

**GEESE**

Raising geese likely was a common and ancient practice on many farms (we have descriptions of domestication in the Greco-Roman world going back to The Odyssey), though the one mention in Cato is only to say that geese are crammed in the same way as hens.482 Pliny mentions geese raised throughout the empire: in Spain, Gaul, Germany, Greece, and Britain.483 Though geese can be raised without swimming water, the ancient authorities acknowledge their fondness for water and—whether out of concern for well-being, as an aid to reproduction and health, or out of benevolent ignorance—only speak of raising them with access to such. Columella uses the word desiderant in describing the relationship between geese and water, which could mean that they simply long for water and he accommodates them. However, his following remarks imply the sense of “require”: that they do not simply enjoy swimming in water, but need it.484 Similarly, Varro’s language is requirit, which could either mean “want, seek” or “need, require.”485 Even if an effort was
required to construct a pond, these birds were considered low-maintenance and lauded for their ease of rearing.

Geese were appreciated not only for their meat, eggs, and feathers, but also as a guardian animal. Columella states that they keep watch more carefully than a dog.\textsuperscript{486} National legend also involved the goose as guardian: the bird is said to have alerted an attack on the Capitol while dogs were silent.\textsuperscript{487} On some farms, geese were also plucked twice a year for their feathers, which could be used as bed stuffing (though this was considered lavish).\textsuperscript{488}

**Housing**

Geese were provided with shelter and nesting spaces and driven daily to fields and ponds. Unlike some other birds, geese were not housed immediately adjacent to the villa due to their need for pasture and water, as well as the lack of importance granted to collecting their manure.\textsuperscript{489} The ideal farm had adequate pasture for the birds and a river or pond, but no nearby market vegetable garden to be gobbled up.\textsuperscript{490} Columella’s *chenoboscia* consisted of an enclosure, exclusively for geese, with nine foot high walls and surrounding porticos within where the keeper’s hut was located. Separate pens were provided for nesting under the porticos made of brick or stone and measuring three feet by three feet, including a door which was shut while the goose was laying.\textsuperscript{491} These were at ground level or below, though dry conditions—aided by generous straw bedding—were considered important.\textsuperscript{492} If no stream or pond was available, an artificial one was constructed. Columella remarks: “they can no more
live properly without the element of water than they can without the element of earth.”

Feed

The primary source of feed would have been whatever forage the birds could find for themselves in fields, which was improved by sowing vetch, trefoil, fenugreek, and lettuce. Barley also appears to have been a regular grain supplement, especially while geese were brooding. The herb *seris*, identified as a kind of chicory or endive, was considered particularly beneficial, though it was cut and given rather than consumed as forage to prevent trampling and overeating. Goslings received soaked barley, millet, wheat, or emmer, and, if desired, cut-up green cress in water. Such a practice mimics the way an aquatic bird would eat in its infancy in the wild, likely promoting health and a fondness for green over grain. Varro recommends barley the first two days and cut-up cress the next three.

As Cato notes, cramming practices were similar to those for chickens. Geese were kept in a warm, dark place and not allowed significant movement. Columella and Palladius recommend beginning the process at four months of age, while Varro begins at one and a half months. They suggest giving barley or emmer flour three times a day, as well as water, and nothing else. Palladius also provided free-choice soaked millet or any legumes except for bitter vetch. Depending on age and the judgment of the keeper, the process took between thirteen days and two months. Pliny praises the excellent quality of goose liver from a crammed bird, and suggests enlarging it by soaking it in honey-sweetened milk. In addition to the grain ration
for the crammed bird, mashed and soaked figs were said to soften the liver if given for twenty days. Access to swimming water, otherwise considered essential for these animals, is absent in cramming discussions, meaning it was known that geese did not need such water. The consideration of high fat content in cramming outweighed the health (and entertainment!) benefits of allowing pond access.

Breeding

Rearing of geese had many parallels to raising peafowl. Large white breeds were preferred, both because of the belief that they are more prolific, and a cultural preference for their meat. The laying season ran from February through the summer solstice, with birds laying three clutches of eggs annually (if they are prevented from hatching their first two, as is recommended). For winter breeding, they were driven to water, an aphrodisiac for them. Columella states that geese would lay successively five, four, and three eggs in each of their clutches. This total of twelve eggs amounts to, at most, about half of the expected twenty to fifty eggs which a modern goose can be expected to lay. This discrepancy could be the result of breeding, feed content, or climate. A ratio of one gander to three geese was suggested. Chicken hens were responsible for brooding and nursing, as in the other fowl, with the exception of the last clutch, if preferred. If the geese were allowed to raise their own offspring during the last clutch, it was made certain that at least some of the eggs were the goose’s own, since it was believed they would not raise the eggs of another. The keeper was responsible for making sure that the birds laid only in their designated enclosures, though it was said that this only has to be done once,
because a goose always lays in the spot where it lays its first egg. Three to five eggs were placed under a chicken, while seven to fifteen under a goose.\textsuperscript{508} Goslings emerged in twenty-five to thirty days depending on the weather.\textsuperscript{509}

Goslings were confined to their pens—no more than twenty in each—for the first five or ten days and fed with their mothers.\textsuperscript{510} Afterwards, weather permitting, they were taken to pasture and stream, but only after receiving chopped chicory and lettuce, as it was recognized that they could not handle the tougher plants in an unmowed or grazed pasture (Columella states that they will actually break their necks trying to eat them.)

**Health**

Recognition of their fondness for swimming water and pasture would have gone a long way in contributing to the health of the flock, and likely explains why they were considered easy to raise. Nettles were used as a remedy for disease and placed under the animals’ bedding, though the sting was known to be fatal to goslings.\textsuperscript{511} Palladius warns against goslings eating the hair of kids.\textsuperscript{512} Varro suggests cleaning out the coops after every feeding while the goslings are confined.\textsuperscript{513}

Pliny has many uses for \textit{anserinus}, “goose grease.” Many of these use the goose lard as a medicinal vehicle to convey herbs or other animal parts: the brain of a horned owl, for instance, is said to heal wounds wonderfully when covered in goose grease.\textsuperscript{514}
Manure

Goose manure was not considered a useful fertilizer. Palladius states that it is “harmful to everything.”

DUCKS

Despite White’s statement that ducks would have constituted an important part of the farm economy, they are given no attention by Cato or Palladius and their treatment by Varro and Columella is fairly brief. The literary clues furthermore suggest that significant domestic strains had not been developed. Though considered an expensive bird which required substantial infrastructure, our authors seem to derive considerable satisfaction from ducks, listing a number of plants which delight the birds, and expressing their joy at seeing them race in the water. Farmers started flocks in one of several ways:

1. Capturing wild ducks and putting them in an enclosure (such birds were noted to be slow to start laying in captivity).

2. Taking the eggs of wild ducks from marshes and incubating them under a chicken (Columella states that this semi-domesticates the ducks and the successive generations will rear their young in captivity).

3. Obtaining ducks from another farmer.

Housing

The duck enclosure was made up of fifteen foot high walls with a net thrown over the top to prevent the birds from flying off (our authors seem to have no concept
of clipping wings for ducks, which can be done to breeds such as the mallard to prevent substantial flight).\textsuperscript{520} If the area did not include a natural pond or swamp, provisions included a two foot deep pond, as large as conditions allowed.\textsuperscript{521} Pond edges were smooth with plaster, creating a level slope that would not be mucked up by the backwash of the water or the ducks and allowing the birds an easy descent into the pond. The outer two-thirds of the pond floor were rammed with stone and plaster to prevent vegetative growth, while the middle of the pond harbored an island on which Columella suggests planting “Egyptian bean,” a type of lily. Mixed forage constituted the rest of the enclosure, with some spaces assigned to large, shady places, and others to lower forage. Grass radiated out from the pond in all directions for twenty feet. Unlike the case with the chicken run, the description of plants in the duck enclosure suggests that it was large enough—or the ratio of duck to land was low enough—that the birds did not eat it down. If a farm had a large number of ducks, a substantial area would have had to be allotted to the project and significant building materials to enclosing it.

**Breeding**

Columella states that the mallard, teal, garganey, and coot birds can be kept in captivity. These ducks today are either wild or, in the case of the domestic mallard, considered close to their wild cousins in behavior, laying, meat production, and self-reliance. The ducks kept by ancient Romans then were hardly domestic, and raising them bore similarities to keeping wild caught thrushes and turtle doves.
Columella’s description of laying areas appears to be confused: on the one hand, he suggests that one foot square plastered stone nesting boxes were provided for eggs with low growing bushes planted between them. We can imagine that these essentially wild birds were not always apt to lay in the human constructed boxes, preferring rather to make their own nests, though the bushes may have provided a sense of privacy which encouraged the ducks to lay in designated places. On the other, he also remarks that during the breeding season (spring), the keeper should provide twigs and stalks for the ducks to make their own nests. It is unlikely that the ducks would take these randomly scattered twigs and move them all to their designated laying boxes, so it is unclear which system or combination Columella actually advocates. Varro suggests that laying areas run along the inside edge of the enclosure wall, built of plastered brickwork.

Feed

Food was provided in channels mixed with water, imitating the way a duck would search for aquatic food. In Varro’s description, these channels ran just in front of the nesting ledges. Panic grass, millet, barley, acorns, wheat and grape husks are suggested. If available, shrimp, prawn, crabs, and shad were also given. These foods were likely high value, so it was a considerable effort to use them in a poultry project. The ducks, especially in their semi-wild state, certainly would have appreciated them, but this practice also suggests considerable effort and therefore fondness for the animal.
Varro mentions that ducks were stuffed, but none of our authors give any account of conditions or feed for this process.\footnote{526}

**Health**

No diseases are mentioned for ducks. Any effort commensurate with the suggestions of Varro and Columella to provide pond access and lush mixed forage would have gone a long way toward promoting well-being. Furthermore, the ducks’ wild nature likely kept them hardy against many ailments. Though the health of ducks is not discussed, these birds are listed as remedies for stomach troubles in other animals. Pliny considers the blood of a drake a remedy for loose bowels. He also states that laying a duck on its stomach will transfer a stomach ache to the duck (which dies).\footnote{527} Likewise, Columella states that the mere sight of a duck will cure stomach troubles in oxen and colic in horses and mules.\footnote{528} Pliny also lists a duck hen’s blood as a poison antidote as well as a means to stop brain hemorrhage.\footnote{529}

**Manure**

Like goose manure, duck droppings were not considered useful as fertilizer.\footnote{530}
HORSES

The ancient Romans used horses in the military, for sport in chariot racing, and as a means of transportation. They were kept on the farm primarily for breeding purposes and mostly seen on well-off estates with the resources to keep, breed, train, and sell them. Depending on their use, horses were conceived of as belonging to distinct groups: the noble class, used in the circus and sacred games, breeding stock, and common. This last class was less intensively managed, though Columella affirms the importance of providing an industrious caretaker and ample fodder for any horses, noting that their feed requirements cannot be neglected up to a point as with some other farm animals. They are not paid much attention to in the earliest source, Cato, who notes only that they are given no holidays except family festivals.

The number of horses on Roman farms increased with the growth of the Republic and Empire to meet military and entertainment demands. Their primary war function was to serve as mounts for the emperor, generals, and cavalrymen, unlike some of Rome’s enemies who used chariot warfare. They pulled vehicles during ceremonial occasions, though rarely, primarily acting as draft and war animals.

Roman horses were smaller than modern breeds, and as in many western cultures today, eating horses was revolting to Roman sensibilities. Mare’s milk was however noted for its purgative effects.
Housing

The ‘common’ stock of horses roamed freely throughout pastures and was not normally stabled. For the ‘noble’ stock, a dry stable was recommended, especially for breeding, though these horses would have spent the majority of their time on pasture as well. Stables had wood floors and were bedded with chaff, which was periodically cleaned out. As with other quadrupeds, pasture varied seasonally with sunny, lush places recommended in the winter, and colder, higher, shadier places in the summer. Pasture with some rough places was recommended to wear down hooves since they were not trimmed.

Feed

Feed for horses came mostly in the form of pasture. Recommended were spacious, wet, even marshy places with few trees and soft rather than tall grass. Horses were put on varying quality pasture based on purpose. Stabled horses received hay. Two plants were especially recommended for horse consumption: one *iugerum*, about a sixth of an acre, of *medica* was said to provide fodder for three horses for an entire year. Ten Roman pounds, about seven U.S., of *cytisus* was said to be sufficient for daily horse feed. This pasture and hay diet is much less adventurous in today’s terms than some of the feeds listed for other Roman farm animals. Horses’ sensitive digestive tract may help explain this. It also seems, based on the *medica* and *cytisus* recommendations, that Roman horses were small and thrifty in feed requirements. Pregnant and nursing mares as well as breeding stallions and foals did receive grain and other supplements.
### Breeding

<table>
<thead>
<tr>
<th></th>
<th>Varro⁵⁴³</th>
<th>Vergil⁵⁴⁴</th>
<th>Columella⁵⁴⁵</th>
<th>Palladius⁵⁴⁶</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body</strong></td>
<td>moderate, big rumps in mares, visible veins for bleeding, broad chest, not prominent backbone</td>
<td>short belly, plump back, muscular chest</td>
<td>broad chest, big shoulder, double spine, drawn in belly, round butt</td>
<td>stallion: massive solid body, long flank, large round rump, broad chest, thick muscle mares: long in belly and body</td>
</tr>
<tr>
<td><strong>Limbs</strong></td>
<td>well proportioned; straight legs sloping symmetrically inward; round but not large knees</td>
<td>straight tall legs, knees not turned inward</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>bay or grey; not white or dun</td>
<td></td>
<td>single and distinct</td>
<td></td>
</tr>
<tr>
<td><strong>Head</strong></td>
<td>not large</td>
<td>high neck, clean cut</td>
<td>small; soft, wide, not long neck</td>
<td>small</td>
</tr>
<tr>
<td><strong>Mane</strong></td>
<td>thick, dark, slightly curling</td>
<td>thick, falling to the right</td>
<td>thick, hanging to the right</td>
<td>abundant</td>
</tr>
<tr>
<td><strong>Eyes</strong></td>
<td>black</td>
<td>black</td>
<td>big</td>
<td></td>
</tr>
<tr>
<td><strong>Ears</strong></td>
<td>erect</td>
<td>short, erect</td>
<td>short, sharply defined</td>
<td></td>
</tr>
<tr>
<td><strong>Nostrils</strong></td>
<td>full</td>
<td>open</td>
<td>flared</td>
<td></td>
</tr>
<tr>
<td><strong>Tail</strong></td>
<td>full, somewhat curly</td>
<td></td>
<td>abundant</td>
<td></td>
</tr>
<tr>
<td><strong>Hooves</strong></td>
<td>hard</td>
<td>hard, high, hollow, round</td>
<td>dry solid foot, high hoof, round</td>
<td></td>
</tr>
<tr>
<td><strong>Testicles</strong></td>
<td>small, even</td>
<td>small, even</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temper</strong></td>
<td>good colt competes with others</td>
<td>doesn’t start at idle sounds</td>
<td>courageous, competitive, not alarmed by unfamiliar things; roused to activity but quiet after</td>
<td>easily aroused from rest, easily stopped after gallop</td>
</tr>
</tbody>
</table>

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⁵⁴³ Varro
⁵⁴⁴ Vergil
⁵⁴⁵ Columella
⁵⁴⁶ Palladius
There were two senses of breed which applied to ancient Roman horses. One, as mentioned above, was the purpose for which the horse was kept and its corresponding treatment. Genera, breeds, were also named based on the district where the stock originated. The advice for selecting good horses is for the most part similar among the sources.

‘Common’ horses were kept in pasture and never separated by sex. Their breeding was not regulated by season, and they gave birth outdoors. Horses intended for more highly esteemed activities, such as racing, were given stricter oversight. Mating ran from the spring equinox to the summer solstice so that the birth would occur a year later when pastures were rich. There were disagreements about proper breeding age:

<table>
<thead>
<tr>
<th></th>
<th>Stallion</th>
<th>Mare</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>three to ten</td>
<td>three to ten</td>
<td>1:10</td>
</tr>
<tr>
<td>Columella</td>
<td>three to twenty</td>
<td>two to ten</td>
<td>1:15-20</td>
</tr>
<tr>
<td>Pliny</td>
<td>two or preferably three to thirty-three</td>
<td>two or preferably three to forty</td>
<td></td>
</tr>
<tr>
<td>Palladius</td>
<td>starts in fifth year</td>
<td>two to ten</td>
<td>1:12-15</td>
</tr>
</tbody>
</table>

Except for Pliny, who seems to consider death the end of breeding (and assumes very long lives for horses), there is agreement that the offspring of a mare older than ten will be sluggish. Horses are a significant exception to the pattern of Romans breeding farm animals at relatively late ages. Breeding a mare at two years of age is actually young for standards in the U.S. today. Ten years of age is however
considered a few years off from declining fertility in older mares, continuing the ancient trend of preference for stopping breeding in older animals. Valuable stallions were kept away from mares (and each other) most of the year either in distant pastures or stables. At the approach of breeding season, their diet was increased with barley and bitter vetch. Varro recommends tying the mare during breeding to speed up the process and ensure a successful coupling. The stallion was admitted twice daily. When male offspring was desired, the stallions left testicle was tied up, when female, the right. If the stallion was uninterested, the breeder would wipe the mare’s genitals with a sponge when she was in heat and bring it to his nostrils. For an uninterested mare, crushed squill was applied to her genitals. Important mares were bred every other year as it was thought to extend their breeding life, fortify their milk, and produce better foals. Varro compares this practice to crop rotation: just as fields benefit from a fallow period, so do animals. ‘Ordinary’ mares bred of their own accord without restriction. However, horses were also thought to become the angriest of any animal when not allowed to breed. This belief was so strong that it was widely reported that mares could become pregnant without fertilization. Through sheer determination and imagination, these horses were impregnated by the ‘wind.’

Pregnant mares were considered fragile and not worked hard. Precautions were also taken to keep valuable mares away from the cold in separate, spacious stalls free of moisture when a harsh winter suppressed pasture growth. The importance of providing ample fodder but not overfeeding is stressed. If there was a miscarriage or the birth did not go well, crushed polypody (a fern) was given in water through a
Once she had given birth, her diet was supplemented with barley. Foals were not touched after birth. The breeder’s job was to provide a spacious warm place for the foal and mare, and care was taken not to let the foal’s hooves get caked with manure. By the tenth day, the foal was spending time with its mother on pasture. Varro recommends giving ground barley meal at five months of age until weaning age, which was not until two (much later than today). Mares were considered to love their offspring more than any other animal.

Castration, common today for males not intended for breeding, is not thoroughly explained. Varro explains that the decision to make a male a cantherius, gelding, is based on its use as it makes them quieter. Palladius mentions only that the procedure takes place in March.

Health

Extensive information is given on horse veterinarian care by Columella and Palladius, who for the most part repeats his predecessor’s advice. Varro, as for cattle, simply states that the pastor should have written remedies. The general advice for health will sound familiar to today’s horse owners: the animal should be rubbed down daily and have access to shelter, water, and exercise at the appropriate times. A back massage was also considered beneficial. Sick horses were well bedded. Like many old timers today, Romans believed that having a horse drink after sweating was dangerous. In addition to this, Palladius lists the most common sources of problems as fatigue, overheating, not passing urine, and standing for an extended period time before working. Specific conditions and remedies include:
1. **Fatigue**: give the horse rest and pour oil or fat mixed with wine down its throat.

2. **Thinness**: give roasted wheat and wine rather than barley. Add in beans eventually. Palladius reports from Greek authorities that ‘double roasted’ wheat and barley should be given, as well as water three times a day. If thin from work, give goat milk, fine meal, olive oil, four eggs, and purslane juice for three days or until well.

3. **Chill**: apply heated oil and soak the head and spine with fat or ointment. In winter, warm the animal in a warm bath and give bitter vetch or bran with warm water. Rub body with heated wine and oil. Draw blood from the neck, chest, throat, or feet. Wash knees with hot vinegar then hot water.

4. **Urination Problems**: pour oil mixed with wine on the animal; if unsuccessful, apply boiled honey and salt to the urine tract, or insert a live fly and a grain of incense or bitumen into the genitals. Ten egg whites mixed with food help.

5. **Headache**: indicated by tears, hanging ears, drooping head. Open the vein under the eyes and foment the mouth with hot water. Keep the horse away from food for a day. The following day, give water and green grass before fodder and bed with straw or old hay. Give water, barley, and vetch that evening.

6. **Jaw Pain or Swelling**: foment with hot vinegar and rub with old grease.

7. **Shoulder Damage**: open the veins in the middle of each leg and put the resulting blood on the shoulders with incense dust. Stop the bleeding by
bandaging the horse’s own manure on the cuts. Repeat the next day and give a little hay. On the third to sixth day, pour leek juice and oil down the animal’s throat. Afterwards, make it walk slowly then swim in a pond and restore the normal diet.

8. **Colic**: Columella describes this condition as trouble with bile, a swelling belly, and inability to ‘emit wind.’ Grease hand and insert it into the anus to remove manure. Crush up ox marjoram and lousewort with salt and mix these with boiled down honey. Insert this potion as a suppository. Some people pour myrrh and wine down the throat and put liquid pitch on the anus. Others wash the bowels with sea water or brine.

9. **Worms**: indicated by the horse rolling in pain, bringing its head to its belly, and frequently flicking its tail. Remove manure with a greased hand and wash the tract out with salt water or brine. Pour down the horse’s throat root of the caper bush and vinegar.

10. **Cough**: if recent, give crushed lentils then pour down the throat a mix of hot water and crushed lentils. Continue this for three days, giving green grass and tree tops. If long standing, pour leek juice in oil down the throat for several days, with the grass and tree top diet.

11. **Impetigo**: rub affected spots with vinegar and alum. If they persist, apply split alum and *nitrurn* mixed in vinegar. Scrap the pustules in hot sunlight until blood flows then apply the root of wild ivy, sulphur, and liquid pitch mixed with alum.
12. **Chafing**: wash the sores twice a day in water and rub them with salt boiled in fat until blood flows.

13. **Scab**: can be fatal. If mild, put on cedar oil, mastic gum, or nettle seed crushed in oil or fish oil from salted tuna. The fat of *marinus vitulus* (sometimes translated as ‘seal’ – maybe the Mediterranean monk seal) works. If more developed, mix bitumen, sulphur, and hellebore with liquid pitch and axle grease, and boil these together. Apply after scraping the sores with a knife and washing with urine. Or, cut the scab and treat the sores with liquid pitch and oil, rubbing on soot from a bronze vessel.

14. **Flies on Wounds**: pour on pitch and oil or fat.

15. **Scars on Eyes**: rub with the saliva of someone fasting and salt, cuttle fish shell pounded with salt, or wild parsnip seed crushed and squeezed through linen over the eyes.

16. **Eye Pain**: put on plantain juice [the small green plant, not the banana] mixed with honey that was obtained without smoking the bees. If this honey is not available, thyme honey.

17. **Nose Bleed**: pour green coriander juice through nostrils.

18. **Aversion to Food**: crush *git*, “Roman coriander,” seeds in oil and wine and pour down the throat. Palladius reports from Greek authorities that black nightshade leaves and germander or bitter vetch in water should be mixed with feed.

19. **Nausea**: give a bruised head of garlic in wine to drink.

20. **Abscess**: open with hot blade, squeeze pus out, dress with lint.
21. **Sudden Collapse**: put fish sauce through the nostrils.

22. **Narcissism**: sometimes mares see their own reflection in water and forget to eat. They run around the pasture like they are being spurred on and looking for something. Cut her mane unevenly and lead to the water so that she can see herself [this phenomenon is reported by Columella and repeated by Palladius, though the latter says that he has never witnessed it].

Pliny also mentions uses of horse products for health in other animals:\(^{567}\)

1. Horse manure and rennet are both used in treatments for bowels.

2. Dried horse tongue in wine is a remedy for spleen issues.

3. Applying foam from a horse’s mouth or ash from its hoof soothes itches.

4. Sores are treated with horse blood or the ash of dried horse manure.

5. The fluid from a mare after intercourse and dried horse testicle in a drink are aphrodisiacs.

As today, age was determined by examining the horse’s teeth. Likewise, the Romans also report that the first incisor/central teeth erupt at two and a half years. Today, a horse usually has a ‘full mouth’ at age five. The Romans also note that the mouth is filling out at this age, but they did not consider it full until age six. It is unclear whether this is a difference in language or a meaningful physical change. The Romans also realized that determining a horse’s age becomes more difficult after this period, though they assert that sinking temples, whitening eyebrows, and projecting teeth are clues.\(^{568}\)
Training

The few descriptions of training horses are focused primarily on doing so for chariot racing with the high grade stock. This process began at age two or three, though it was recommended that a foal be handled periodically before this time. Harnesses were hung in stalls so foals became accustomed to the sight, and once weaned, the young animal spent time with a bit in its mouth. Once accustomed to being handled, a boy would mount the horse two or three times, first on his stomach, then seated. Beyond this, little information is given. Varro however does prescribe a particular diet for horses just beginning training: mixed cut fodder was fed for ten days with no other food as a purge; from the eleventh to the fourteenth day, only barley was fed in increasing amounts daily; the amount of barley fed on the fourteenth day was continued another ten days. After this purge, the horse was gently exercised and rubbed with oil after sweating.

Columella recommends that a horse start racing one year after it begins training (which is three under his recommendations), while Pliny recommends breaking at two but only racing at five. Horses were hitched to vehicles by means of harness and bit, and blinders appear to have been used by some. The lower stock not destined for esteemed purposes was delegated to the mill and threshing duties.

Manure

Horse manure is not often mentioned as a source of fertilizer, though we can assume that it was lumped into the category of ‘quadruped’ manure, somewhere between bird and pig manure in terms of utility for the farms that had it. Pliny does
note that horse manure has different qualities based on the animal’s feed. He distinguishes between ‘light’ manure and ‘heavy’ manure, which is produced from feeding barley. The former was applied to grain land, the latter pasture as it was thought to be better for grass growth. \(^{574}\)
Donkeys

Donkeys were widespread throughout the Roman world from the earliest villas through to the end of the Empire. These animals were considered critical to any farm operation because of their frugal feed needs and tolerance for work as well as their (perceived, at least) capacity to handle a degree of negligence and blows. They are described as rarely affected by hunger, immune to many diseases, and the slowest to break down of the draft animals. Still, they were categorized as a “lesser” farm animal, cattle, horses, and mules being “greater.” This distinction is no doubt due in large part to size—donkeys are smaller—yet this attitude seems to extend to the degree of care Romans showed their donkeys.\(^{575}\)

Donkeys were commonly used to turn mills and haul out manure, though they also plowed light soils and bred horses for mules. Cato supposes that a 240 \textit{iugera}, roughly 150 acre, oliveyard should have three donkeys for hauling manure, one for the mill, and one \textit{asinarius}, donkey keeper. The 100 \textit{iugera}, roughly 62 acre, vineyard had two wagon donkeys, one mill donkey, and one \textit{asinarius}.\(^{576}\) Arcadia in Greece and Reate, modern Rieti, in Italy were major donkey producing areas with respected stock.\(^{577}\)

Wild asses were fairly common in the Roman world, though not in Italy, and were more frequently depicted in art than their domestic counterparts. Taken alive by lasso, they were used for breeding and served as food in some areas. Asia Minor was a noted area for their capture.\(^{578}\) While domestic donkey foals were reported as food in areas outside of Italy, they were not eaten around Rome. Their milk however was considered especially powerful.\(^{579}\)
Housing

There is almost no mention of housing for donkeys among the Roman agriculture writers. We can assume that accommodations were not elaborate. Pliny does mention that there should be lots of space in a shelter for donkeys because they roll around frequently. 580

Feed

Donkeys were valued because they could be kept easily on farms with little pasture, feeding on leaves, thorns, and twigs. Varro asserts that the best foods for them are spelt and barley bran, while Columella claims that they actually gain weight on chaff. Pliny notes that the plant ferula, giant fennel, is good for donkeys. 581

Breeding

Attention to conformation in donkeys was not as rigorous as it was for many other farm animals. Varro simply mentions that breeding donkeys should be sturdy and sound in all parts, full bodied, and from the best regions such as Reate. There was a usual guarantee of soundness upon purchase. Both domestic and wild jacks were used, though the authorities disagree about the suitability of wild asses for breeding. Varro considered them fairly easy to tame, and once so, incapable of reverting. Pliny also considers wild jacks suitable. Columella, on the other hand, asserts that they are difficult to train and rebellious. 582

Breeding occurred near the summer solstice for birth the following year around the same time. According to Pliny (who often gives earlier breeding dates for
farm animals than the other sources), jennies were considered ready for pregnancy at two and half. Males started breeding at three. Jacks were considered better prepared to breed if they had been working and were tired, while females were made to gallop after intercourse. If a jenny was having successive years of pregnancy, she was bred six days after foaling. Pliny claims that donkeys breed throughout their lifetime of thirty years (he often does not set an upper limit to breeding age in farm animals, unlike other sources).583

Donkey foals were not separated from their mother until a year after birth and even so spent the second year with her at night. This is a very late weaning compared to modern practice. However, mare’s milk was considered more nutritious and surrogate horse mothers were common for foals intended to become breeding jacks. Foals were given straw, hay, and barley.584 More attention is paid to breeding with donkeys in the sources’ discussion of mules (see infra).

Health

Donkeys were considered an exceptionally hardy animal and most writers did not give specific instructions for health. Pliny only mentions that they do not endure the cold well. He also gives applications for donkey products in human health:585

1. Dried and pounded donkey kidneys in wine are a remedy for bladder trouble.
2. The right testicle of a jack taken in wine is an aphrodisiac.
3. Crushed and boiled donkey bones, especially those of a wild donkey, are a remedy for sea hare poison.
Donkeys were employed for work in mills, in the field hauling loads of manure, for plowing light land, and as pack animals. Every farm was expected to have donkeys for the mill and carrying loads to town. They are also depicted pushing a grain harvesting implement called the *vallus*, invented in the first century AD. Varro asserts that training begins in the third year of life, but gives no further instructions. Like horses, they are depicted in harnesses with blinders.

Manure

The donkey was considered the best manure source of the quadrupeds since it chews its food slowly. It was rated below fowl and human manure, but either equal to or above goat, sheep, horse, cattle, and pig manure. Donkeys were the power source for spreading all the farm’s manure, pulling carts loaded with it.
Mules

Romans bred *muli*, mules, and *hinni*, hinnies, though as today, the former were more popular. Mules were used primarily to draw vehicles on roads and as pack animals on journeys, preferred over horses for transport, but less important than oxen for farm work. Columella does mention that they are useful for plowing, though considered more expensive and less capable in heavy ground than working cattle. Mules are mentioned by the earliest source, Cato, though only to say that they do not receive holiday except on family festivals (a precept agreed upon by Columella). They were generally imported at this time from Greece, though by the time of Varro breeding them was profitable in Italy. It is clear that mules were quite important for transportation in the Roman world: carts and carriages were usually pulled by pairs of them. Their prevalence on individual farms however would have been affected by the villa’s ability either to maintain horses or to justify buying a mule financially.

Housing

As with donkeys and most horses, mules spent the majority of their time on pasture foraging. There are no specific references to shelters for them, though we can assume—as for donkeys—a covered area was provided for protection from the rain. When possible, mules were driven from low, flat ground in the winter to high, rocky ground in the summer. The importance of exposing hooves to rough ground to maintain good structure was emphasized. There is no mention of trimming hooves in the sources, so exposing the animals to rough terrain was the primary means of keeping good form. Horses and mules were certainly not shod as they are today with
rigid metal horseshoes, but there is a reference in Pliny to a horse casting off his *vestigium*—translated as shoe—which he advises picking up as a cure for hiccups. It is unclear what exactly a *vestigium* was for equine, though it could have been some sort of sandal. Nevertheless, it does appear that mules’ hooves were for the most part prepared for road transport through natural wear on rocky pasture.\(^{593}\)

**Feed**

The topic of feed specifically for mules is not extensively covered by the Roman agriculture writers. In addition to pasture, barley, hay, and cut fodder crops are mentioned, all in the context of breeding.

**Breeding**

The bulk of the writings about mules are descriptions of how to breed for them. The first consideration was the lineage of the jack. A donkey intended for breeding mules was preferably raised by a surrogate horse mother to fortify him on her abundant milk and accustom him to their species. Jacks raised this way were considered more amenable to breeding mares than their counterparts raised by donkey mothers. Donkey foals intended to become breeders were put in with surrogate mares under the cover of darkness after taking away the mare’s own foal. This effect could also be produced by having the donkey foal spend time around horses from a young age, if there was no surrogate horse mother.\(^{594}\)

A jack which was sired by a wild ass was also considered especially suitable for breeding, as the third generation was thought to be sufficiently tame yet still
courageous. Mules whose father, rather than grandfather, was wild were considered to have a fierce spirit, though the authorities disagree about whether this was desirable. In the absence of such jacks, the largest donkey of good stock—from Arcadia or Reate—was selected. According to Columella, the ideal jack had ample stature, a strong neck, broad flanks, a big muscular chest, brawny thighs, solid legs, and black or spotted color. Palladius also considers grey and red suitable. If the donkey had different colors in his eyelids or ears, these were thought to be passed to the offspring. Jacks began service at age three and were fortified with fodder crops and barley before breeding.

The sources are in complete agreement that mares should be bred between the ages of four and ten when coupled with a donkey, as foals from old mares were considered sluggish. Columella recommends a large, beautiful, hard worker, while Palladius prefers a large mare with strength over speed. Pliny alone recommends that a mare intended for mule breeding, like a jack with such responsibilities, also be raised on the milk of the other species (donkey). Mares which had been bred previously were preferred, especially for a first time jack, since they were less likely to kick their mate off and discourage his interest in horses.

Breeding for mules occurred at the same time of year as for horses (from the spring equinox to the summer solstice), and the gestation period was recognized often to be longer than it is in horses. If the jack was uninterested, he would be put in with a jenny, then once aroused, she was substituted for a mare. If, on the other hand, the jack was too aggressive, biting the mare when attempting to breed, he was put to the mill for a period of time for hard work. It was considered important that the jack
have moderate exercise before coupling, as it was thought that his seed would convey
the energetic quality. When a mare was unexcited with her chosen mate, she was put
with an undesirable donkey, whose job was to spend time with her until she became
aroused. Once this happened, the preferred donkey was substituted. A breeding
machina (platform, device, machine) could also be constructed consisting of two
walls with a narrow space between them on sloping ground. The mare was fastened
with a halter to a cross bar with her forefeet on the lower end of the slope so that she
was leaning forward, making it easier for the smaller donkey.600

Care of mule foals is not covered extensively, but can be assumed to be
similar to that for horses. Foals were raised on their mother’s milk for one year, at
which point they were weaned and sent to pasture on rough mountainsides to harden
their hooves. Columella recommends not breeding back a mare in her first year with a
mule foal.601 Hinnies were bred in a similar fashion, though considered slower and
more like a donkey.602

Health

A primary concern with mules—the result of their use in road transport—was
hoof health, managed by having them reared on rough mountainous pastures, rather
than artificially trimming them. The importance of breeding for good hoof structure
was also considered.603 In most respects, mules were medically treated in the same
ways as oxen and horses. A list of specific conditions and remedies for mules is also
put forth by Columella and Palladius.604
1. **Asthma**: draw blood and give horehound juice mixed with wine and
   frankincense oil.
2. **Spavin**: apply barley flour and open the area with a lancet. Dress it with lint.
   Pour fish pickle and oil mixed with four egg whites through the animal’s left
   nostril.
3. **Ankle Blood Blisters**: cut or sometimes cauterize.
4. **Founder**: [described as flowing of blood down to feet] draw off blood or give
   *veratrum* (hellebore) or henbane seed crushed with wine.
5. **Thinness**: pour beaten sulphur, raw egg, and myrrh mixed with wine down
   the throat frequently (works for cough and stomach pain as well). Green
   *medica* will fatten, but must be given in moderation or the animal “will be
   choked by excess blood.”
6. **Exhaustion**: pour fat and wine down the throat.
7. **Intestinal Pain/Colic**: the sight of a duck will cure a mule.
8. **Heat**: when a mare mule goes into heat, provide raw cabbage.

Pliny also lists human medical applications involving the mule: \(^{605}\)

1. Sneezing and hiccups are cured by kissing a mule’s nostrils.
2. The passions of love are lessened by sprinkling on dust in which a mare mule
   has wallowed.
3. Applying ashes from a mule hoof to the skin will regrow hair lost through
   mange.
4. Chafing under the feet is healed by applying mule urine and mud.
Draft

There are no references to training mules specifically other than that a kicking habit can be stopped by giving them frequent drinks of wine. They were used as pack animals and for drawing vehicles on roads both in civilian and military life. They also plowed in certain circumstances and participated in ceremonial functions. Columella maintains that a horse mule is a better pack animal, while a mare mule is more nimble, though both sexes were used for all purposes.\textsuperscript{606}

Manure

Specific references to mule manure do not exist. Most farms probably treated any mule manure they had as they did horse manure.
Dogs

Dogs were just as common on Roman farms as any other animal and considered indispensable to the security of the villa and its livestock. Columella recommends that buying a dog is one of the first things a farmer should do in order to guard against thieves—the farm/guard dog, *canis villaticus*—and protect livestock—the sheep dog, *canis pastoralis*. In addition to these two roles, dogs also served as hunting companions, though this was not advised for farmers as it takes them away from their work. They are also depicted in art pulling carts and chariots. As today, the loyalty of dogs was much esteemed, and they were widely considered the most faithful of animals. Columella waxes:

“*quīs famulus amantior domīni? quid fidelior comes? quis custos incorruptior?*” what servant is more loving to its master? what companion more faithful? what guard more incorruptible?

Dogs were also a common symbol of fidelity in funerary art. However, while some dogs in the Roman world may have been considered beloved companions or pets, ancient attitudes toward canines do not always align with modern. Pliny reports that nursing puppies were considered such pure food by the ancients that they were used as sacrificial victims for the gods, and even in his own time they could be found on menus at ceremonial dinners. Dogs were also sacrificed in ancient ceremonies before grain ripening. Nevertheless, despite the wide variety of roles dogs could take in the ancient Roman world—companion, guardian, hunter, draft animal, food—most rural villas kept a few dogs primarily for security.

Housing
Built structures are not specifically described for dogs, though they certainly were given shelter. Guard dogs were either shut up or tied during the day to make them more active and vigilant during the night when they were needed for protection of the villa and its animals. Sheep dogs went wherever their flock was, in pastures by day and either in the shelter or pastures by night, depending on the villa’s system for its livestock. Dogs were bedded on rainy days with leaves or other organic material to keep them from muddy and chilly conditions, and puppy litters were bedded with chaff.  

Feed

The importance of adequately feeding dogs was stressed so that they would not be tempted to leave their charge to hunt. Foods mentioned include barley bread soaked in milk, barley flour mixed with whey, and emmer or wheat bread mixed with the liquid of cooked beans (must be lukewarm, because if warm will cause madness!). Meat scraps and bones were commonly fed, the latter of which was thought to make their teeth stronger, gape wider, and spirits higher. Livestock guardian dogs were not allowed to feed on any dead sheep.

Breeding

When acquiring new dogs for the farm, it was recommended that they neither be too young nor too old to protect the villa adequately. Varro and Columella describe the ideal guard dog.  

<table>
<thead>
<tr>
<th></th>
<th>Varro</th>
<th>Columella</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>full, thick shoulders and neck, backbone neither curved nor projecting</td>
<td>full, squarely built, broad shaggy chest, wide shoulders</td>
</tr>
<tr>
<td>Color</td>
<td>white so can see in the dark</td>
<td>same all over: white for sheep dog so can distinguish, black for guard dog for intimidation and stealth at night</td>
</tr>
<tr>
<td>Face/head</td>
<td>handsome, large head, symmetrical nostrils, wide gape</td>
<td>very large head, broad shaggy chest</td>
</tr>
<tr>
<td>Teeth</td>
<td>two teeth projecting a little from jaw on each side</td>
<td></td>
</tr>
<tr>
<td>Eyes</td>
<td>dark or gray-yellow</td>
<td>black or gray</td>
</tr>
<tr>
<td>Lips</td>
<td>blackish or reddish, upper lip neither raised too high nor drooping</td>
<td></td>
</tr>
<tr>
<td>Ears</td>
<td>large, hanging</td>
<td>hanging</td>
</tr>
<tr>
<td>Legs</td>
<td>straight</td>
<td>thick, rough</td>
</tr>
<tr>
<td>Paws</td>
<td>large, wide, separated toes, hard curving nails, spongy sole</td>
<td>large joints</td>
</tr>
<tr>
<td>Tail</td>
<td>thick</td>
<td>short</td>
</tr>
<tr>
<td>Bark</td>
<td>deep</td>
<td>loud</td>
</tr>
<tr>
<td>Teats (female)</td>
<td>equal</td>
<td></td>
</tr>
<tr>
<td>Temperament</td>
<td></td>
<td>neither mild nor too fierce, stern, not fawning, vigilant, observant rather than rash, always grows hot at strangers</td>
</tr>
</tbody>
</table>

Sheep dogs, on the other hand, were leaner and swifter than guard dogs, though not so much as hunting dogs. Longer, slimmer builds were preferred to the square frames of guard dogs, but otherwise the qualities listed above are the same. While these characteristics were bred for, Columella also asserts that a dog’s upbringing affects its qualities.
The most respected breeds acquired their names from their place of origin: Spartans, Epirotes (northwest Greece), and Sallentines (southeast Italy). Varro advises against buying dogs from hunters, stating that they will chase wild animals instead of staying at the farm or with the flocks. He recommends buying directly from shepherds either untrained dogs or dogs trained to follow sheep, noting that dogs easily form habits. One farm preferably had dogs all from the same family, as they were thought to be a better protection to each other. The same liability conditions were stated when purchasing sheep dogs as for the purchase of sheep. Some bought per head, some stipulated that puppies went with their mother, and some bought two puppies for the price of one dog.\textsuperscript{613}

Dogs of both sexes began breeding at one year of age (coupling them earlier than this was thought to enfeeble their young bodies and degenerate their minds), though Pliny mentions that the Spartan breed began at seven months.\textsuperscript{614} Columella recommends that males breed until ten years of age and females nine, while Pliny suggests breeding until age twelve for both sexes. Varro advises spring breeding for birth around the summer solstice, while Pliny advocates that dogs breed twice a year. Feeding the pregnant mother barley bread rather than wheat bread is suggested as it was thought to increase milk production. As today, Pliny notes that the average litter size is five to six. He also suggests impressive lifespans of fifteen to twenty years for most breeds and ten years (male)/twelve years (female) for the Spartan breed.

Not all the puppies were kept, however. The farmer selected the desired animals and got rid of the others (presumably killed them), allowing the surviving puppies to have more milk. Pliny advises that the best puppies in a litter are the ones
that acquire vision last (puppies are born with their eyes closed). Columella recommends that the first litter any female produces be taken away from her because she will not be able to raise them properly and nursing will hinder her growth. Surrogate mothers however were not recommended for puppies with desirable qualities, as their biological mother’s milk and spirit was thought to be particularly helpful for the puppies’ physical and mental development. In the case that the mother was not producing enough milk, the puppies were supplemented with goat milk.

Puppies were allowed to nurse whatever they could for over two months, and for a few months after that were not allowed to roam freely except when playing with their mother. Encouraging play was recommended, though not to the point of exhaustion. Puppies were accustomed to being tied, at first with light ropes, and whipped if they gnawed at them. By six months, they were kept tied during the day and let loose at night. Castration was practiced by some—who believed it made males less likely to stray from the flock—and not by others—who thought it made the animals less fierce. The technique is not described.

Columella gives a list of appropriate names, stating that they should be short (two syllables) so that the dogs will obey quickly:

**Male**: σκύλαξ (puppy), λάκων (Spartan), celer (swift), ferox (fierce)

**Female**: σπουδή (speed), ἀλκή (strength), ῥώμη (might), cerva (hind), lupa (she-wolf), tigris (tigress)
Succinct lists of remedies for conditions specific to dogs are provided, though otherwise it is recommended that canines be treated like other quadrupeds.

1. **Protection from Wild Animals**: leather collars with extruding nails around the neck were recommended as a protection against attacking wild animals. The underside was soft so as not to injure the dog’s neck.\(^{617}\)

2. **Flies**: crush either *nuces Graecae* (hazelnuts) or *nuces amari* (bitter almonds) in water and rub on the ears and toes. If sores already exist, drip boiled liquid pitch mixed with lard.\(^{618}\)

3. **Ticks**: fall off if touched with boiled liquid pitch mixed with lard. Do not pluck off by hand or will cause sores. A tick removed from the left ear of a black dog and worn as an amulet is a pain reliever.

4. **Fleas**: smear crushed cumin mixed in water with the same weight of hellebore on the body; or, apply the juice of the *anguineus* (snake-like) cucumber; if these are unobtainable, use *amurca*.

5. **Scabies**: mix ground gypsum and sesame with liquid pitch and smear on the affected part; if bad, use juniper juice.\(^{619}\)

6. **Lice**: remove the eggs with dog fat.\(^{620}\)

Columella also recommends docking tails forty days after birth by breaking a nerve with your teeth. Short tails were preferred aesthetically and thought to prevent rabies.\(^{621}\)
Pliny gives an extensive list of remedies for dog bites scattered throughout his work, some of which are meant explicitly for bites inflicted by rabid dogs (the efficacy of which he is curiously confident about):

1. Apply crushed garlic and mature pickle fish.  
2. Apply the ash of a dog’s head or ash from the hair underneath the tail of the dog which inflicted the bite. 
3. Eat the dog’s liver raw. 
4. Apply walnuts chewed by a fasting person. 
5. Take *alysson* (madwort) in vinegar and wear it as an amulet. 
6. Apply the ash of a river crab. 
7. Put wool on the bite. 
8. At the start of hydrophobia—a rabies symptom—cauterize the wound with iron and the affected person will be relieved at once. 
9. Once hydrophobia sets in, rub the affected person’s face with seal fat (see p. 137), or more effectively seal fat mixed with hyena fat, mastic oil, and wax. 

Even more remedies are listed for bites which are not explicitly rabid. These include washing the wound in the affected person’s own urine and applying any of: *garum* (fish sauce), iris in oil, grape vine ash in oil, laserpitium juice, bitter almonds with honey, pounded black horehound with salt, nettle with salt, garlic with honey, young fig shoots, rosehip, plantain, antimony mixed with fat and litharge of silver, axle grease pounded with lime, a buck’s liver, a doe’s urine in wine, the hair of adult men with vinegar, *nitrum* (soda) with vinegar and resin, *salsamenta* (another fish sauce), sponge with vinegar, cold water, and honey, and mussels with honey. Bites were also
cut and bandaged with veal, while the affected person drank veal broth. Alternatively, a drink containing a mix of badger, cuckoo, and swallow dung was administered.\textsuperscript{624} Dog’s blood furthermore was considered a remedy against poison arrows. Fumigating a home with the gall of a male black dog while sprinkling dog’s blood on its walls or burying its genitals under the threshold of the door is listed by Pliny as protection from sorcerers.\textsuperscript{625}

Guard

Dogs guarded two distinct realms of the villas: the flocks—most commonly sheep, though also goats—and the steading. The number of sheep dogs was determined by flock size and predation pressure in the area, though one dog per shepherd was a rule of thumb. If the flock always fed near the villa, two dogs were considered sufficient. Varro recommends that every villa have at least two dogs, one male and one female, as it makes them keener. He also reports via Saserna that dogs will follow someone who has given them boiled frogs.\textsuperscript{626} Pliny states that dogs run away from anyone carrying a dog’s heart and they will not bark at someone who has a dog’s tongue placed in their shoe under the big toe, is carrying the severed tail of a weasel which was released, is holding a dog’s afterbirth, or is holding rabbit hair or manure.\textsuperscript{627}

Manure

Dog manure is not mentioned.
Bees

Of all the lessons we can learn from the Romans about farm animals, the most important may be about bees. While their biology was often confused or wrong concerning insects, their practical management of hives was highly skilled. Many ancients wrote extensively on bees, including all the sources of this work with the exception of Cato, whose only references to bees are indirect – recipes with honey in them.628 A great deal of study and practice can be devoted to beekeeping and the magnitude of Roman writings on the topic reflects this. It would be possible to write an entire book on the ancient Italians’ treatment of bees. In fact, such a book has been written, *Beekeeping in Antiquity* by Malcolm H. Fraser, in which detailed overviews and commentaries on each source’s discussion of bees may be found. In a world without cane or beet sugar, honey was by far the most important sweetener for the Romans. It was also fermented into mead (*aqua mulsa*), mixed with wine to form *mulsum*, and combined with vinegar to make oxymel, a medicinal drink.629

It is clear that the Romans were fascinated with the structure of the hive and accorded a great deal of respect to bees, comparing them in complexity to human society. Varro wrote of them:

*apes non sunt solitaria natura, ut aquilae, sed ut homines… haec ut hominum civitates, quod hic est et rex et imperium et societas.*

bees are not of solitary nature, like eagles, but are like humans… they have a state like humans, since there is a king and government and society.

Vergil composed in admiration of their loyalty to their ruler and declared that bees had *partem divinae mentis*, part of the divine mind, and *haustus aetherios*, a drink of heavenly air. Pliny likewise calls them chief among insects and wonders at their organization, comparing it both to a Republican government and a military camp,
moreover stating that they are actually better than humans at recognizing common
interest. Bees were linked in a variety of ways to Jupiter in mythology and
considered omens: according to Vergil, a swarm of bees is a bad portent; however,
Pliny considers it a good omen, stating that bees hung off Plato’s mouth when he was
born. Bees were also used as prognosticators of weather, since they stay inside if it
is going to rain.

Nevertheless, Roman writings contain many errors regarding bee biology,
most notably that the queen bee was considered a king (for the purpose of this
chapter, she will be referred to as a queen). They also made the mistake of thinking
that younger bees, rather than older, are the outside workers and the group that
swarms (the opposite is the case). The Romans were furthermore confused about the
source of honey and its production as well as the utility of drones, bees’ lifespan, and
their reproduction. However, they did recognize some fundamentals: that colonies
have division of labor—some bees gather food, some build comb, some raise young,
some guard, etc.—and produce a variety of products including comb, honey, propolis
(sometimes called bee glue, a resin used to strengthen combs and cover over any
unwanted matter in the hive that cannot be removed, like mice), erithace (bee bread,
fermented pollen capped with a thin layer of honey and used as winter food by the
hive), and wax.

Traditionally, a small number of hives were kept fixed to the outside of the
villa wall. Vergil writes in this tradition and seems to source a lot of information from
his own experience, rather than a paid overseer, though he did have written sources.
Varro introduces the large apiary, consisting of substantial infrastructure with rows on
rows of hives. Like his predecessor, Columella also maintained a large apiary with an overseer, though it is unclear how intimately the two actually worked with their bees. Neither mentions being stung by bees, with only Pliny mentioning that bee stings can be avoided by carrying a woodpecker beak in a pocket. These large apiaries could be highly productive and successful financially: Varro claims that a certain Seius leased his apiaries for a rent of 5,000 Roman pounds of honey annually, 3,627 U.S. pounds. Beyond the experience of his own farm, Columella relied on written sources from around the ancient world, including the Carthaginian Mago, Cassius Dionysius, Hyginus, Vergil and Celsus.

Pliny states that bees were considered neither wild nor domesticated. They were certainly carefully tended to and housed as domestic animals, though wild swarms were caught and a passage in Cicero describes slaves collecting wild honey from the forest. In Roman law, bees were considered wild. The right of a villa owner to the hives’ honey rested on his authority to stop an intruder from trespassing on his property. Once a swarm from the apiary was out of sight, no one had a legal right to it.

Housing

Hives were made of a variety of materials and likely ranged in scale from a few household hives to large apiaries with hundreds of colonies. Romans used horizontal, cylindrical hives which were opened at the back, rather than the top. They were called *alvi*, bellies, because of the nourishment within. Some of these hives had covers on each end which could be slid forward or backward, changing the size.
of the structure. Pliny recommends sliding the cover back as the bees fill the hive with honey so that they are motivated to continue. There were no removable frames, so observation abilities were restricted. The *mellarius*, beekeeper, presumably could only see the front or back combs unless the hive was made of transparent material.\(^{641}\) The sources’ preferences for hive building materials are organized below in a chart modeled from one in *The World History of Beekeeping and Honey Hunting* by Eva Crane:\(^{642}\)

<table>
<thead>
<tr>
<th>Material</th>
<th>Varro</th>
<th>Vergil</th>
<th>Columella</th>
<th>Pliny</th>
<th>Palladius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cork Bark</td>
<td>x (best)</td>
<td>x</td>
<td>x (best)</td>
<td>x (best)</td>
<td>x (best)</td>
</tr>
<tr>
<td>Giant Fennel</td>
<td>x</td>
<td>x (good)</td>
<td>x (second best)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Willow Wicker</td>
<td>x (smear with cow dung inside and out)</td>
<td>x (if cork, giant fennel not available)</td>
<td>x (third best)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Hollowed Log</td>
<td>x</td>
<td>x (if cork, giant fennel, willow not available)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood Boards</td>
<td>x</td>
<td>x (same preference as log)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dung</td>
<td>x (fire hazard when smoking hives)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pottery</td>
<td>x (worst)</td>
<td>x (worst)</td>
<td>x (worst)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brick</td>
<td>x (not preferred because immovable)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparent</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Movable Hive Ends</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Varro advises that a hive be three feet long and one foot in diameter. Each hive had a few separate small entrances in the middle of the hive just big enough for one bee. The small entrances prohibited larger vermin from entering and made temperature control easier, while the multiple exits allowed the bees several paths of escape should a lizard be positioned in front of one entrance ready to eat any bee which might fly out.643

Small apiaries consisted of a few hives attached with brackets either to the outside villa walls or to the villa portico. Larger apiaries were separate structures. In the latter case, the hives were situated in a temperate location with protection from the wind and freedom from any strong odors, including mud, the baths, or animal stalls. The smell of burning crab was especially advised against. It was also recommended that the location not have echoes. The bottom of a valley was considered ideal for the apiary so that the bees could fly downhill home while loaded with pollen. If the villa was in such a location, the apiary was located on the side of the building opposite of the baths and latrines and walled off. If not, a close valley was preferred so that the owner would visit frequently.644

A large apiary was enclosed on all sides by short brick walls or, if thieves were feared, tall walls with small openings in the middle so that the bees could exit. Within the apiary, the hives rested on a three foot high wall of stone thoroughly plastered so that lizards and snakes could not climb up. The hives were either placed some distance apart or had partitions between them. Apiaries had multiple rows of hives on top of each other, each hive sloping slightly downward to the front so that any water would drain out. A colonnade or foliage smeared with clay as a roof is
suggested to keep rain out by Columella, though others might not have wanted the
shade. A room for the caretaker and a storehouse containing empty hives, herbs, and
medicine was adjacent. Hive entrances faced south to east, toward the winter
sun. Trees, shrubs, and herbs were planted around the apiary both for food and to
provide a landing place for swarming hives. Mobile hives also existed: Pliny
reports that on the Po River in northern Italy hives were conveyed each night
downriver until they were so heavy as to weigh the boats down, at which point they
were harvested. In Spain, hives were carried by mule.

Feed

Romans took feeding bees as seriously as feeding any other farm animal,
planting pastures for the sole purpose of providing flowers for honey production.
These pastures were devoid of other farm animals and ideally situated in locations
with plenty of sun but also shelter from storms. Beneficial plants for bees
included:

<table>
<thead>
<tr>
<th>Herbs</th>
<th>thyme, <em>apiastrum</em> (bee balm), <em>serpyllum</em> (type of thyme), savory, oregano, rosemary, <em>cuniila</em>, <em>melittis</em>, lemon balm, <em>citrago</em>, marjoram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td>asparagus, <em>gourds</em>, cabbages, carrot, wild mustard, wild radish, wild turnip, <em>wild endive</em>, wild <em>parsnip</em>, mustard</td>
</tr>
<tr>
<td>Legumes</td>
<td><em>clover</em>, <em>medica</em>, lentils, pea, beans, bitter vetch, sweet clover</td>
</tr>
</tbody>
</table>
Every source adds something new to the list, though many plants are repeated. Thyme was widely considered the best plant for honey quality, and Pliny states that thyme honey does not crystallize. Some bruised the herb in a mortar, soaked it in water, and sprayed it on the bee pasture. *Cytisus* was also considered particularly beneficial, especially for colony health. Pliny states that oak, linden, and reeds produce the best honey. The plants considered of second best quality by Columella and Palladius were savory, *serpyllum*, and oregano, with rosemary of third quality. Spanish broom, arbutus, and vegetables were thought to produce the lowest quality honey, while spurge, hellebore, thapsia, wormwood, wild cucumber, dogwood, and *aegolethron* were advised against all together.

The importance of providing a suitable water source was also stressed. Shallow flowing water near the hives was preferred. Well water was hauled by hand if no brook or spring was near. Tiles, stones, or sticks were placed in the water as landing pads so that the bees could drink without threat of drowning. Varro and Pliny also advise supplementing forage and honey during extended bad weather, drought, or times of low honey. Varro suggests ten pounds of boiled ripe figs rolled into lumps and placed near the hive – Fraser notes that Varro could not place the food in the hive because of design, so he had to risk robbing by other bees by placing it outside the hives. Varro also suggests honey water with wool in it so that the bees could safely suck without drowning, as well as pounded raisins and figs soaked in boiled wine and made into pellets (specifically for winter). Pliny mentions raisins and crushed figs, raisin wine, mead, and poultry flesh.
Varro also believes that different plants supply the material for one or more of the bee products, which he lists as honey, *erithace* (bee bread), wax, and propolis. Curiously though, while describing which plants correspond to which products, he names only honey, wax, and *cibum* (food), which might be referring to bee bread.656

<table>
<thead>
<tr>
<th>Honey</th>
<th>Wax</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pomegranates</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Asparagus</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Olives</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Figs</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Beans</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><em>Apiastrum</em></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Gourds</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cabbages</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Apples</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Wild Pears</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Poppies</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Almonds</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Brassica</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Breeding**

The nature of bee reproduction was uncertain in ancient Roman times. Varro suggests that bees come partly from bees, partly from rotting bull carcasses; Vergil states that offspring comes from the bees’ mouths, foliage, and herbs; Columella is
uncertain whether bees arise from intercourse or flowers, though he thinks it is irrelevant to honey production; Pliny notes two theories, though the existence of drones makes him question both: that bees are formed from reed and olive blossoms, and that a single male (the misidentified queen) is responsible for reproduction with the other female bees. He recognizes that bees aided in brood rearing while moving on the combs, likening this work to a hen sitting on eggs. However, he also thought that hatching took forty-five days—for workers, it is actually nineteen to twenty-two—showing Roman ignorance of the internal workings of the hive.⁶⁵⁷

The queen bee was referred to as a rex, king, but accurately described as larger with proportionately smaller wings. Queens were thought either not to have a sting or not to use it (the latter is most accurate: queens normally only sting other queens). The Romans also recognized that queens were reared in different cells than worker bees.⁶⁵⁸ Drones were a mystery. They were looked upon unfavorably, considered lazy, and sometimes called fuci, thieves. Some ancient beekeepers even went so far as to kill the drones. However, despite widespread recognition that they do not collect food or sting, some Romans did have a sense that they contribute something to the hive. Columella suggests that they play a role in terms of reproduction, though he does not understand how. He furthermore advises against killing drones, stating that the other bees are more active when drones are around eating their food. Pliny states that drones contribute to the warmth of the hive. He also recognizes that drones are driven from the hive when there is a dearth of honey.⁶⁵⁹
It appears that several types of honeybees were kept by the Romans. One distinction was between wild bees, all those which built hives in the woods and fed there, and tame bees, which fed on cultivated ground. Wild bees were described as smaller, hairy, better workers, and more aggressive.\textsuperscript{660} The Romans also described divisions between the tame bees. The preferred bee was small, round, smooth, striped, shining, and calm. Long, hairy bees did not receive approval. Columella also states that bees become tamer the more they are handled. Fraser interprets this statement as meaning requeening.\textsuperscript{661}

Adding a new hive to the apiary was accomplished in one of three ways: capturing a swarm from the apiary itself, collecting a wild swarm, or buying a hive. Columella and Palladius describe the method for capturing a woodland hive in the spring: when looking for bees, go to a woodland spring. Touch their backs with liquid red ochre as they are drinking so that you can recognize them when they return. If the bees return quickly, their hive is near, in which case you can follow them back. If the bees return at longer intervals, their hive is far away. Drop a little honey in a reed with a hole in it and place it by the spring. Once the bees have gone in, place your thumb over the hole to trap them. Release a bee and follow it until it is out of sight. Continue letting one at a time out of the reed, following it as far as you can, until you have found the hive. If the hive is in a cave, drive them out with smoke and beat brass, which will frighten them so that they land on a nearby shrub or tree, at which point you can put them in a vessel. If the wild hive is in a hollow tree, cut the branch or trunk at both ends, cover it with a cloth with no holes, and carry it back. Swarm searching should occur in the morning so that the bees will definitely return to the
spring. Alternatively, some people smeared empty hives in bruised bee balm, other herbs, and a little honey, and then left them out in the woods until a swarm settled in it. This method was not advised when there was a danger of thieves.  

Hives were also bought from neighbors, though bringing in bees from distant locations was not advised. Transferring the hives was done in spring with particular care that the new location had suitable forage so that the bees would not abandon the new villa. Hives were moved at night on shoulders rather than carts to avoid bumps. For journeys lasting more than one night, the hives were not moved during the day and the bees were kept shut up but fed a liquid solution. Once the hives arrived at their destination, they were opened first at night. The buyer was advised to look for bees frequently entering and exiting the hive, bright bodies, and equal, smooth combs. The noise of the hive was also considered. Columella recommends blowing into the entrance to incite a sound if none is heard. Shaggy and rough looking bees were not considered suitable for purchase unless this condition was caused by a busy time of year for the bees. Never purchasing undesirable bees and not mixing inferior bees into other hives was stressed.

Health and Hive Management

The Romans actively managed their bee hives, examining them several times a month during the spring and summer. The *mellarius* only handled the hives when in a chaste state: sober, having abstained from sex for a day, wearing no perfume, and not smelling of any strong foods such as pickled fish, garlic, or onions (bad smells incite stinging). Hives were lightly smoked when worked with an earthenware
vessel containing live coals and galbanum or dry manure. The smoker had handles and a small opening on top. There are few mentions of stings in the sources, and the Romans seem to have feared getting stung very little. There are also no references to veils for working around the hives, though it also could have been considered too obvious to note. Pliny does give a semi-accurate description of stings, noting that sources disagree whether bees die immediately after stinging or only if the stinger went deep enough to be ripped out (bees cannot withdraw their stings once inserted, though do sometimes live hours afterwards even with a ripped abdomen).  

Once opened at the arrival of spring, hives were cleared of any worms, moths, or vermin and again fumigated with cow manure. Mixing cow marrow with manure in the smoke was said to cause worms to fall off combs when applied to the hive. Early spring was considered a dangerous time for bees, since they were prone to an ailment believed to be the result of over-eating spurge, almond, dogwood, and elm flowers, which caused diarrhea. Suggested remedies included giving the bees either human or cow urine or rosemary boiled in honey water to drink, and feeding them supplemental foods, such as crushed serviceberry in honey, pomegranate seeds with Aminean wine, raisins with sumac, or all those ingredients pulverized and cooked in sharp wine. These were cooled and placed in wooden troughs. Columella, sourcing from Hyginus, suggests that the dead bodies under the hive in this scenario be set aside until the equinox, at which point they were brought out in the third hour of sunlight with fig wood ashes on them. Within two hours, the bees were said to be crawling. Fraser lists three possibilities for this diarrhea phenomenon: 1) after observing the spring cleansing flight, they were actually finding bees which had died
over the winter; 2) the supplemental spring feeding actually caused it; 3) the bees had been feeding on honey that was damp and fermented as the result of a hive defect allowing too much moisture. He also notes that some symptoms point to bees which were starving in late winter.$^{668}$

When the mallows were in flower—for Palladius, this is April—a concerted effort was made to eliminate moths in the apiary. A burning light was placed under a stone shaped like a milestone: tall, thin, and hollow. The moths, which were most numerous at this time, were attracted to the light but could not escape the stone, and so burned to death. Pliny suggests doing this at the new moon.$^{669}$

Swarming was generally observed from mid-spring to the summer solsticen. Generally, Romans rejoiced at the opportunity to catch a swarm from the apiary and begin a new hive, rather than manage existing hives to discourage swarming. However, Pliny and Columella do mention that swarming can be stopped by cutting the wings of the queen—according to Sammataro and Avitable, clipping does not actually control swarming—and Palladius states that bees will not swarm if the mouth of the hive is smeared with the manure of a first born calf. During this time, hives were attentively watched during the first eight hours of daylight, after which they were not likely to swarm. Though they did not fully understand the nature of swarms—they believed that a young queen, rather than the older, established queen, led a swarm—the Romans took assiduous steps to ensure their capture.$^{670}$ During the appropriate time of year, the beekeeper put his ear to each hive in the evening, listening for a particular buzzing sound likened to an army about to march, which was believed to occur for three days prior to swarming. A number of bees hanging off the
entrance of the hive massed like grapes and emitting a loud humming noise, especially in the evening, was also considered a signal a day or two before swarming. Once a swarm left the hive, the beekeeper threw dust on them and rattled brass. An empty hive—having been stored nearby—was smeared with bee balm and honey and placed under the desired landing place, usually a nearby tree, which had also been smeared with herbs. Columella advises that more than one cluster of bees hanging off a branch indicates multiple queens. In this scenario, the mellarius was instructed to pick out the less desirable queen with a hand smeared with bee balm and parsley juice and kill her. The bees were lightly smoked before being placed in the new hive by hand or a scoop, and put in their permanent location that evening.

From late summer to the equinox, Columella suggests fumigating the hives with smoke every ten days and pouring cold water on empty spots in the hive to wash away any crud. A stiff feather was used in hard to reach places for sweeping out caterpillars and moths. As Fraser points out, cleaning the hives would have been challenging if indeed they could only be opened from the back. A thorough fall cleaning and fumigation with smoke from cow manure and thyme took place on a sunny day, at which point covers were put in the hive next to the last comb to get rid of any empty space in the structure. Any chinks in the hive were smeared with a mix of clay and cow manure or leaves at this time. Some killed birds, took out their intestines, and placed them in the hives as a source of winter warmth for bees crawling in the feathers. In winter, hives were bedded with straw, leaves, or stalks and not opened. However, if the bees were thought to be hungry, dried figs pounded and
soaked in water, or raisins with water were provided. Wool was used as a device through which the bees could suck any liquid food. Columella also suggests that by February 13 most of the honey is usually gone, so sweet liquid should be dropped in through small pipes.  

Romans also combined and requeened hives. The queen was interfered with in instances of:

1. **A weak hive**: the existing queen was killed and a developing queen and worker brood were placed in the hive at the point when they were gnawing away at their cells. When mixing hives, the *mellarius* sprinkled sweet liquid in the hive and kept the bees shut up with food and small air holes for three days. Palladius also suggests combining hives during a season in which none of the hives are active enough to swarm.

2. **Multiple queens**: when there were multiple queens in one hive, all but the strongest queen was killed.

3. **Aimless activity**: Vergil advises that bees appearing to fly away from their hives aimlessly should be restricted by tearing the queen’s wings off.

4. **Old age**: Columella notes that some beekeepers get rid of old queens, though he does not recommend this practice, believing that her attendants will be displeased like senators forced to obey a younger king. In the case of a queen dying of old age and multiple replacements appearing, he suggests transferring all but one to hives in a need of a queen.

5. **Disease**: queen cells were cut away in diseased hives, presumably to introduce the genetics of a new queen.
Romans described robbing as battles between hives, though they recognized that it occurred as a result of scarcity. Dust, raisin wine, honey water, or mead was thrown on robbing bees and smoke was applied. Pliny suggests putting out milk or water sweetened with honey as a means of reconciliation between the hives. Vergil recommends killing the weaker queen of the two involved hives.\textsuperscript{679}

The recognized signs of sick bees were: dead bodies being carried out of the hive, a change in bee color, thinness, roughness, a duller humming sound, and amassing by the entrance. Healthy bees on the other hand were judged by their merriment and brightness. General remedies for illness included:

1. Burning galbanum.
2. Giving honey through reed pipes.
3. A blend of pounded gallnut and dried rose leaves or boiled down fat and grapes with thyme and centaury.
4. Boiled roots of Italian starwort in wine.\textsuperscript{680}
5. Moving the hive if the suspected cause was lack of forage.\textsuperscript{681}
6. Fumigating the hive and cutting out diseased combs.
7. Adding more bees (but keeping only one queen).
8. Transferring honey comb with some brood already eating its way out to the suffering hive.\textsuperscript{682}

Specific conditions mentioned are:

1. \textbf{Loss of Flight}: when bees were knocked down by an unexpected storm, they were collected and placed under cover in a warm spot. The following day they were dusted with fig wood ash and shaken gently in a vessel. Finally, they
were placed in the sun near the hives. If the storm caused significant loss of bees in a hive—or there were otherwise empty brood cells which could not be filled—colonies were combined and the empty comb was removed.  

2. **Deformity:** bees described as being in a hideous shrunken state were given food in reed troughs, especially boiled honey with oak apple or dried rose. Galbanum was burned and the juice of starwort root boiled with Aminean wine was given.  

3. **High Foraging, Low Reproduction:** during a phenomenon in which several successive years of strong flowering has caused hives to focus on foraging to the detriment of brood rearing, the exit to the hive was closed every three days.  

4. **Poisonous Honey:** Pliny mentions instances of poisonous honey and gives as a remedy fine *mulsum* with rue and *salsamenta* (a type of pickled fish).  

5. **Foulbrood:** Pliny also gives the name *claron* to a condition in which combs are not filled, which Fraser identifies as foulbrood.  

6. **Pests:** newts, beetles, hornets, moths, spiders, wasps, mule flies, frogs, swallows, and sheep’s wool were all identified as enemies of bees. Olive oil placed on insects’ (including bees’) heads in the sun was said to kill them.  

Some sources suggest an odd method of beginning a new apiary in case of total bee loss: a narrow structure made with roof tiles and close walls was built with four windows, and a yearling bull was made to lie in it with his nostrils and mouth stopped up. He was beaten to death and his flesh pounded to a pulp through his uncut hide.

After placing branches, thyme, and cassia on the dead animal, bees were said to
spring forth from the body. While Democritus, Mago, Vergil, and Pliny report this phenomenon, Columella sides with Celsus in saying that it does not occur.⁶⁸⁹

Columella and Pliny state that a single hive will not live more than ten years, even if it raises brood well, so new swarms and hives should be continually acquired. Pliny gives a span of seven years for bees’ life, though it is unclear whether he is referring to individual bees—which is unlikely, considering other sources seem to recognize that bees have short lifespans—or is simply reporting hive lifespan from a different source in a confusing way. This source may be Vergil—who also suggests a seven year lifespan in an ambiguous way, either referring to individual bees or individual hives, while noting that the family lives longer.⁶⁹⁰

Honey and Wax

Though the Romans were uncertain about the origins of honey, they did recognize that different conditions lead to different qualities in honey. Pliny suggests that honey comes from a mix of air, dew, and flowers, though he correctly states that bees ‘vomit’ it out and water content is reduced as bees make honey. Thyme was widely regarded as producing the best honey, while rosemary was stated to produce a thick product.⁶⁹¹ Romans judged that honey was ready to harvest by signals of a certain humming noise in the hive, capped comb, and a flight of drones.⁶⁹² Pliny states that honey is more copious at the full moon.⁶⁹³ Honey was harvested in the morning, so that bees would not be bothered by heat. Columella mentions a two and a half foot harvesting instrument: an oblong knife with a broad edge having a curved scraper on one end for cleaning and a flat sharp edge on the other end to cut the
<table>
<thead>
<tr>
<th></th>
<th>Dates</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varro</td>
<td>May 10, end of summer (up to nine-tenths of the honey for these harvests), early November (only if well-stocked, in which case take no more than a third)</td>
<td>do not take the same amount every year: just as in crops, ‘fallow years’ are beneficial; if removing a large amount, do not take it all at once</td>
</tr>
<tr>
<td>Vergil</td>
<td>May, November</td>
<td>rinse your mouth with water before harvesting (presumably to remove bad smells)</td>
</tr>
<tr>
<td>Columella</td>
<td>first harvest (exact date not specified, one fifth of the honey is left), fall equinox (leave one third)</td>
<td>practices not the same in every location; leave fullest combs, brood cells; after harvesting, turn the hives around so that the next time you will be taking old comb</td>
</tr>
<tr>
<td>Pliny</td>
<td>May (some take up to fourteen-fifteenths, others leave entirely to nourish brood), summer (most medicinal, leave a tenth or more if hive not full), after September 12 (leave two-thirds and any bee bread)</td>
<td>wash yourself prior to harvesting; bees do not like menstruating women; smoke the hive thoroughly but not so much that the bees die; afterwards, smear the hives with crushed bee balm and greenweed to encourage the bees to stay</td>
</tr>
<tr>
<td>Palladius</td>
<td>June (leave one fifth), October (leave one half or more)</td>
<td>remove moldy combs; do not take the ‘November honey’ from tamarisk and wild shrubs</td>
</tr>
</tbody>
</table>

The sources give varied timing and quantities of harvest, as represented in the preceding chart.\(^694\)
Honey was made the same day as harvest. Once the combs were cut out, they were brought into a secure room and the entrance was smoked. After any remaining brood was removed, the combs were placed into cone strainers made of wickerwork or reeds with a basin underneath to catch the honey. Linen was also used as a strainer. After the comb was crushed and honey strained, it was transferred to earthenware vessels left open for several days and frequently skimmed. The comb was again squeezed into a basket for second quality honey which was stored separately.  

Wax served as light, writing tablets, embalming material, and medicine in antiquity. Columella states that it has little monetary value but many uses. After washing the remains of the extracted combs, they were thrown into a bronze vessel with added water and melted over a fire. The wax was then poured out and strained through straw or rushes, heated a second time, and finally poured into molds in which a little water was added to the bottom to allow easy removal of the hardened wax.
Conclusion

The Romans were clearly a people with a strong agrarian value system. Many of the most prominent writers and statesmen of ancient Italy extolled the virtues of farm life (though they did not always fully live it). Cato began this literary tradition, stating at the opening of his work:

\[ At \text{ ex agricolis et viri fortissimi et milites strenuissimi gignuntur, maximeque pius quaestus stabilissimusque consequitur minimeque invidiosus, minimeque male cogitantes sunt qui in eo studio occupati sunt. } \]

Yet from the rustic people are born both the bravest men and most strenuous soldiers, likewise their occupation is most honorable, most durable, and least hateful, and those who are employed in this endeavor are not likely to have evil thoughts.

This strong and—I would argue—often helpful respect for farming and the earth was unfortunately marred in many instances by inequitable land distribution and slave-based labor practices. Both sides of the Roman influence—respect for small, independent landowners, as well as harmful labor practices—linger through Western history. Roman farm manuals were influential throughout Western Europe beginning in the medieval period, and Columella has been quoted by a number of prominent English authors, including Charles Darwin. Moreover, many parallels between Roman agrarianism and the antebellum South can be drawn. Thomas Jefferson’s home Monticello—which included a Roman fishpond—was inspired by Varro’s description of a villa.

There are many good reasons why Roman influence on farming should continue, though areas of influence of course should be chosen wisely. Some practices are clearly cruel (beating a bull to death in hopes that bees will emerge), some clearly ineffective (placing a duck in front of a horse as a cure for colic), some disputable (does planting, harvesting, and breeding by phases of the moon make a
difference?) Many approaches, however, deserve a second look, especially for farmers interested in animal welfare, sustainability, and low-capital farming, even if these were not the motivations of their Roman proponents. Some general ancient farm theories about livestock may strongly resonate with sustainably minded farmers today: animals should be fed from the farm’s crops, crops should be fed from the farm’s animals; stock should be brought in locally for low stress (rather than acquiring distant super breeds); late weaning, when coupled with off-years for the mother, promotes health; pastures should be rotationally grazed. Likewise, some approaches for specific animals may also be helpful. These may include, for instance, the Roman awareness that ducks are happier and healthier with access to water, bees have a better chance of thriving when certain pastures are managed specifically for them, and hogs can reach suitable market weight— with time— on a woodland, acorn based diet.

These and many other ancient methods deserve cautious, though not dismissive, consideration. However, the most appropriate advice for how to engage with Roman farm practices may come from Varro himself: 702

For nature has given us two routes to agriculture, experiment and imitation. The most ancient farmers determined many of the practices by experimentation, their descendants for the most part by imitation. We ought to do both—imitate others and attempt by experiment to do some things in a different way, following not chance but some system...
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636 Varro III, xvi. 10; Pliny XXI, xli

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