

Control Methods. An internal feeder is always a difficult insect to tackle. Bordeaux mixture was, however, tried as a repellent but did not show any good effect. One method which can be suggested is to work up the soil underneath the tree so that the pupae may be destroyed.

Acknowledgements The authors take this opportunity of thanking Mr. Mani for describing the fly.

AGRICULTURE IN ANCIENT ROME

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In an earlier number of this journal, (Vol. XXIV No. 5, May 1936) an account of agriculture in ancient Greece was given. It was shown that the art of Agriculture was fairly well advanced in ancient Greece. The Romans not only improved the art considerably but also spread it in the countries conquered by them. Many of their learned men have written on the subject. The most important of these authors are Cato, Varro, Virgil, Columella, Pliny and Palladius.

Cato was the 'father of the Roman rustic writers'. His *De Re Rustica* is the oldest work on Roman agriculture. Varro had written 500 volumes on different subjects and his *De Re Rustica* is a valuable book on Roman agriculture. Virgil's *Georgics* may be considered as 'a poetical compendium on agriculture'. Columella's *De Re Rustica*, in twelve books, is 'a complete treatise on rural affairs, including field operations, timber trees and garden'. Pliny was a great naturalist and his *Natural History*, in thirty-seven books, gives much valuable information on Roman agriculture. The *De Re Rustica* of Palladius, a poem in fourteen volumes, is 'little more than a compendium of those works which preceded it on the same subject'.

Based on these works, the Rev. Adam Dickson, a Scotch clergyman published, in 1788, a treatise under the title of *The Husbandry of the Ancients*. The article on the agriculture of the Romans, in Loudon's *Encyclopaedia of Agriculture*, published about a century ago, was based on all these works. The materials for the following account of agriculture in ancient Rome have been taken from Loudon's *Encyclopaedia*.

Rome was founded by a company of robbers and runaway slaves under the leadership of Romulus. The chief, having conquered a small portion of Italy divided it among his followers, each getting one or two acres. For the first few centuries, the agricultural holdings were generally small and the lands were occupied and cultivated by the proprietors themselves. These soldier-agriculturists 'ploughed their fields with the same diligence that they pitched their camps, and sowed their corn with the same care that they formed their armies for battle'.

In course of time, when Rome extended her conquests and acquired large territories, rich individuals purchased large estates. These were either

leased out to farmers or were cultivated by the landlord through a bailiff or overseer. In the former case, either the farmer paid rent for the farm or he received a certain proportion of the produce for his labour, the stock of the farm belonging to the landlord. In the latter case, the management of the farm was entrusted to a bailiff. The landlord, however, was perfectly acquainted with every kind of work on the farm and could judge the work done at the farm in his absence. The Roman landlords were very careful and exact in the management of their country affairs.

In the early days, the Roman villas were small and plain but in course of time they became large and magnificent. The position of the villa and the situation of the different parts were very carefully attended to. The villa was divided into three parts, the *Urbana*, the *Rustica*, and the *Fructaria*. The *urbana* contained the apartments of the landlord; the *rustica* contained the kitchen, the houses of the labouring servants, the stables, piggeries, and poultry houses, ponds for water and dunghills. Adjoining it, in the residence of the opulent Romans, were placed the aviary, apiary, a place for dormice, a warren for rabbits and hares, a place for snails, and a large enclosure or park of fifty acres and more for retaining live deer and wild beasts taken in the chase. The *fructaria* contained the oil and wine cellars, the places for the oil and wine presses, the cornyards, barns, granaries, storehouses, repositories for roots and fruits etc.

The servants, employed in Roman agriculture were of two sorts—freemen and slaves. When the proprietor or the farmer lived on the farm and directed the cultivation, these were directly under his management; in other cases, there was a bailiff or overseer to whom all the other servants were subordinate. The bailiff was generally a person who had received some education and could write and keep accounts. 'It was expected that he should be careful, apt to learn and capable to execute his master's orders with a proper attention to situations and circumstances. He ought not to trade on his own account, nor employ his master's money in purchasing cattle or any other goods; for this trading takes off his attention and prevents him from keeping square accounts with his master'.

Regarding the other servants, 'the careful and industrious should be appointed masters of works; these qualities are more necessary for this business than stature or strength of body, for this service requires diligent care and art.' "In the ploughman, though a degree of genius is necessary, yet it is not enough; there should be joined to it a harshness of voice and manner, to terrify the cattle; but he should temper strength with clemency; because he ought to be more terrible than cruel, that so the oxen may obey his commands, and continue the longer at their work, not being spent, at the same time, both with the severity of labour and stripes.'

All the servants were maintained and clothed by the farmer or the proprietor. They were given good treatment by the masters. It is said, concerning the bailiff, that 'he should not eat but in the sight of all his servants, nor of any other thing but what was given for the rest.' Three to

ive pounds of bread according to the seasons and a daily allowance of a weak wine, on an average of about a pint and a half a day, were given to all the servants. The dress was such as to give protection against wind, cold and rain.

The labouring cattle were chiefly the ox, the ass, and the mule. Horses were very rarely used for agricultural purposes. 'The respect for the ox which existed among the Egyptians, Jews and Greeks was continued among the Romans. The breeding, breaking, feeding and working of the ox are dealt with in detail by the Roman writers on agriculture. 'Bulls should be all, with huge members, of a middle age, rather young than old, of a stern countenance, small horns, a brawny and vast neck and a confined belly.' The cows most approved of were 'of a tall make, long with very large belly, very broad forehead, eyes black, and open, horns graceful, smooth and black, hairy ears, strait jaws, very large dewlap and tail and moderate hoofs and legs.'

Labouring oxen were fed with the mast or nuts of the beech or sweet chestnut, grape stones and husks after being pressed, hay, wheat and barley straw, bean vetch and lupine chaff, all parts of corn and pulse, grass, green forage and leaves. The leaves used were those of the helm oak, ivy, elm, the vine, the polar etc.

Oxen were worked in pairs abreast both with the cart and plough and stood in the stables also in pairs. They were carefully matched in order that the stronger might not wear out the weaker. 'Oxen, when in the plough, were not allowed to go a great way without turning; one hundred and twenty feet was the length fixed upon, and further than this, it was thought improper for them to pull hard without stopping. It was thought proper that oxen in ploughing should be allowed to stop a little at the turning and when they stopped, that the ploughman should put the yoke a little forward, so that their necks might cool. Unless their necks are carefully and regularly cooled, they will soon become inflamed and swellings and ulcers will arise. The ploughman, when he has unyoked his oxen, must rub them after they are tied up, press their backs with his hands, pull up their hides, and not suffer them to stick to their bodies; for this is a disease that is very destructive to working cattle. No food must be given them until they have ceased from sweating and high breathing, and then by degrees, in portions as eaten; and afterwards they are to be led to the water and encouraged by whistling'.

Asses were used chiefly for carrying burdens or for the mill, or for ploughing where the land was light. Mules were used for both the road and the plough provided they were not too dear and the stiff land did not require the strength of the ox.

The agricultural implements used by the Romans were many. The most important implement was, no doubt, the plough. 'They had ploughs with mouldboards and without mouldboards; with and without coulter; with and without wheels; with broad and narrow pointed shares; and with shares not

only with sharp sides and points, but also with high-raised cutting tops. The Romans used suitable implements for the various processes of cultivation.

Ploughing was the most important agricultural operation. The season for ploughing was any time when land was not wet; the furrow was kept equal in length throughout and straight. Deep ploughing was employed even up to a depth of two feet. The plough was generally drawn by one pair of oxen, guided by the ploughman without the aid of a driver. 'In breaking up a stiff land he was expected to plough half an acre, in free land an acre and in light land an acre and a half each day.' Land was ploughed in square plots of 120 feet to each side.

Fallowing was a universal practice. Generally a crop was followed by a year's fallow but when manure was available two or more crops were taken in succession and on rich soils a crop was taken every year. In fallowing, the land was ploughed after the removal of the crop and then cross-ploughed in spring and then before sowing. 'There was no limit to the number of ploughings, the object being, to let the earth feel the cold of winter and the sun of summer, to invert the soil and render it free, light and clear of weeds, so that it can most easily afford nourishment.'

Manuring was held in high esteem by the Romans. All vegetable, animal and mineral sources were tapped. The dung of birds was considered the best, human excreta and cattle dung being next in importance. Dung-hills were placed near the villa their bottoms hollowed out to retain the moisture and their sides and top protected from the sun by twigs and leaves. Dung usually remained in the heap for a year. It was then laid out on the land in spring and autumn, the two sowing seasons. No more was to be spread than could be ploughed in the same day. Frequent and moderate applications of dung are recommended instead of occasional abundant application. The dung of birds was often applied as top-dressing. 'Crops that were sickly were revived by sowing over them the dust of dung, especially that of birds.' Green crops, especially lupines, were sown and before they came into pod ploughed in as manures; they were also cut and buried at the roots of fruit-trees for the same purpose. Trees, twigs, stubbles etc. were burned for manure. It was believed that lands manured with ashes of trees would not require manure for five years. Lime was used as manure, especially for vines and olives.

Sowing was done by hand and the seeds covered with the plough or with the hoe and rake. Weeding was generally done by pulling the weeds up with the hand and the soil was stirred with the hoe. Horse-hoeing was also practised, the origin of which 'was due to the injuries of war. The Salassi, when they ravaged the lands lying under the Alps, tried likewise to destroy the panic and millet that had just come above ground. Finding that the situation of the crop prevented them from destroying it in the ordinary way, they ploughed the fields; but the crop at harvest being double what it used to be, taught the farmer to plough amongst the corn.' This operation was performed 'either when the stalk was beginning to appear or when

the plant had put forth two or three leaves. The corn being generally sown in drills, or covered with the plough, so as to come up in rows, readily admitted this practice.'

In reaping corn it was a maxim that it is 'better to reap two days too soon than two days too late'. Reaping was done in one of the following ways:— (a) cutting close to the ground with hooks, a handful at a time, (b) cutting of the ears with a curved stick and a saw attached and (c) cutting the stalks in the middle, leaving the lower part or stubble to be cut afterwards. Reapers were generally divided into two groups and set on the opposite sides of the field and they worked towards the centre. The Romans did not bind their corn into sheaves. When cut, it was sent direct to the threshing floor. If the ears only were cut they were sent in baskets to the barn. The threshing floor was circular and it had a diameter of 40 to 60 ft. It was generally placed in the open air as near the barn as possible in order that when a sudden shower happened, during the threshing, the ears may be carried to the barn quickly. The corn was spread over the area a foot or two in thickness and was threshed or beaten out by the hoofs of cattle or by dragging a machine over it. This machine was made of 'a board, rough with stones or iron, with a driver or great weight placed upon it'. Corn was cleansed by winnowing when there was wind. After being dressed, the corn was laid in the granary and the straw either laid aside for litter or "sprinkled with brine; then, when dried, rolled up in bundles, and so given to the oxen for hay.'

Hay-making was of great importance among the Romans. The meadows were mown when the flowers of the grass plants began to fade; as it dried it was turned with forks; it was then tied up in bundles and carried home to be stored. Hay was also made of leafy twigs of poplar, elm and oak spray.

Watering on a large scale was applied both to arable and grass lands. Draining was also particularly attended to. Fencing was done only to a limited extent, generally by the planting of trees or of briars and thorns, and rarely by walls of stone or bricks. Trees were pruned and felled at different times according to the object in view. Fruits were gathered by hand.

Among the cereals grown by the Romans were wheat, barley and maize on a large scale and rye, millet and oats to some extent. Of legumes they cultivated beans, peas, chick-pea, lupins, vetch, tare, etc. The sesamum was an important crop cultivated for the seed from which an oil was expressed which was used as a substitute for olive oil. The herbage plants were clover, lucerne and the cytissus. Turnip and rape were much esteemed and were carefully cultivated. Flax was a very important crop raised by the Romans. Willows were grown both for basket-making and as ties and poles for olives and vines. Copse-wood was grown for fuel. Among the timbers which were abundant were oak, elm, beech, pine etc. Fruit trees were extensively cultivated. The more important were the vine and olive on an extensive scale and figs, pears, apples etc. Almost all vegetables known

to us with the exception of potato and a few others were grown by the Romans.

The Romans held in high esteem the maxims of farm management handed down from generation to generation and the Roman writers have recorded a number of such maxims derived from the Greeks and from their own traditions and experience. Some of the more important of such maxims only can be noticed within the scope of this article.

There were several maxims cautioning landlords not to be rash in building their villas.

'Men should plant in their youth, and not build till their fields are planted; and even then ought not to be in a hurry, but take time to consider.'

'Build in such a manner that your villa may not be too small for your farm nor your farm too small for your villa.'

'Proportion the expense of the building to the rent or to the profit arising from the farm.'

'An edifice should be built according to the value of the farm and fortune of the master, which, immoderately undertaken, it is commonly more difficult to support than to build. The largeness of it should be so estimated, that, if anything shall happen to destroy it, it may be rebuilt by one or at most two years' rent or profits of the farm in which it is placed.'

"To sow less and plough better" was a maxim indicating that the extent of the farms ought to be kept in their proper bounds and possibly an advocacy of thin sowings and better cultivation. 'You may admire a large farm, but cultivate a small one.'

The importance of the master's presence in every operation of the farm was emphasised by many maxims.

'Whoever would buy a field ought to sell his house lest he delight more in town than in country.'

'Wherever the eyes of the master most frequently approach, there is the greatest increase.'

'Though every person knows that the presence and attention of the master is of great importance in every business, yet every person does not know, that in no business are they so important as in farming.'

That more can be gained by cultivating a small plot well than a large area indifferently is illustrated by many sayings and stories.

'A vine-dresser had two daughters and a vineyard; when his elder daughter was married, he gave her a third of his vineyard for a portion; notwithstanding which, he had the same quantity of fruit as formerly. When his younger daughter was married he gave her the half of what remained, and still the produce of his vineyard was not diminished.'

'A freedman, who having much larger crops than his neighbours was accused of witchcraft and brought to trial. He produced in the forum a stout daughter, and his excellently constructed iron spades, shears and

other tools, with his oxen and said "These, Romans, are my charms". He was accuited

Industry is considered essential for successful farming. 'The ancients considered him a bad husbandman who buys what his farm can produce to him; a bad master of a family, who does in the day-time what he may do at night, except in the time of a storm; a worse, who does on common days what is lawful on holidays; the worst of all, who on a good day is employed more within doors than in fields.'

Kindness and humanity to servants is strongly recommended. 'Slaves must not be timid nor petulant'. 'They who preside must have some degree of learning and education; they must be frugal and older than the workmen, for the latter are more attentive to the directions of these, than they are to those of younger men. Besides, it must be most eligible that they should preside, who are experienced in agriculture; for they ought not only to give orders but to work, that they may imitate him, and that they may consider that he presides over them with reason, because he is superior in knowledge and experience; nor is he to be suffered to be so imperious to use coercion with stripes rather than words, if this can be done'.

The making of experiments was very strongly recommended to farmers. 'Nature has pointed out to us two paths, which lead to the knowledge of agriculture, viz. experience and imitation. The ancient husbandmen, by making experiments, have established many maxims. Their posterity, for the most part, imitate them; we ought to do both, imitate others and make experiments ourselves not directed by chance but reason'.

The art of agriculture was not only familiar to but held in high estimation by every Roman soldier. It was practised by him in every foreign country in which he was stationed and he taught it to the inhabitants of the country. As Rome extended her conquests, agriculture was introduced into the conquered areas. 'The great agricultural advantage which mankind has derived from the Romans is the diffusion of the art by their almost universal conquests. The Romans spread their arts with their conquests; and their agriculture became that of all Europe at an early period of our era'. As the Empire declined, agriculture also declined and with the Roman power in Europe agriculture was extremely neglected.

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