

a silk sieve of 180 threads to the inch. There can be no doubt but that this state is the one most favourable to their efficiency as manure. Bores are placed at some disadvantage from the fact that they cannot easily be reduced to this fine powder. On the other hand, however, their solution in the soil is much favoured by the decomposition of the animal matter which they contain.

What soils are most suited for the application of undissolved phosphates? We have seen that the natural solvent for phosphate of lime in a soil is the carbonic acid which the air and water of a soil always contain. This carbonic acid is most abundant in soils rich in humic matter, and its quantity is greatly increased by manuring the soil with farmyard manure, or with other decomposing carbonaceous matter. We should expect therefore that dark soils, rich in humic matter, would be those most suitable for applications of undissolved phosphates. We have seen also that carbonate of lime has a great effect in diminishing the solubility of a phosphate. We should conclude from this fact that on limestone and chalky soils undissolved phosphates would produce their smallest results.

The above conclusions are strikingly confirmed by some extensive trials of French coprolite made in France in 1857, the results of which were reported by M de Molon to the French Academy in 1858 (*Comptes Rendus*, vol. xlvii., p. 233.) French coprolite contains much more sand than Cambridge coprolite, and usually rather less than 50 per cent. of phosphate of lime. This coprolite was employed in fine powder, with and without animal manure. It was also used as superphosphate. The trials were conducted simultaneously in eighteen departments. More than 11,000 acres of land were treated with the coprolite manure, 2214 tons of coprolite being employed.

M. de Molon sums up the results of this extensive trial as follows:—1. On clay, schistous, granitic, and siliceous soils rich in organic matter, the coprolite may be used with advantage in the state of simple powder. 2. On the same soils, if poor in organic matter, especially when they have been long under cultivation, or have recently received a dressing of lime, the coprolite powder must be mixed with animal manure. 3. On limestone soils, especially chalk, the coprolite is applied with most advantage in the state of superphosphate.

Farmers who are desirous of trying the effect of powdered phosphates on their land, cannot do better than act on the experience here described. Of all soils, pasture should be the one most suited for the use of undissolved phosphates, grass land being always far richer in humus than arable soils. A dressing of 3 cwt. of finely ground boneash per acre, or 4 cwt. of South Carolina phosphate, applied in early spring, would probably be found effective wherever the soil stood in need of phosphatic manure.

On arable soil the general value of undissolved phosphates is much more questionable, and the farmer should certainly ascertain by careful comparative trials whether finely ground phosphates will yield a paying result on his fields before employing them on any considerable scale. Making powdered phosphate into a compost with farmyard manure, or even with vegetable refuse, some time before its application to the land is worth a trial. Or the powdered phosphate might be

applied as a dressing after the dung is spread on the land, and then both ploughed in together.

On chalky soils a few trials of Redonda phosphate would be of interest. The phosphate of aluminium, of which this cheap and almost useless phosphate is composed, might possibly be partly decomposed by the carbonate of lime in the soil, and a portion of the phosphoric acid brought into a condition suitable for plant food.

In dealing with all sparingly soluble manures the amount of rainfall will have considerable influence. In a dry season such manures will be almost without effect, while in a wet season they may exert a considerable influence. The character of the soil and season having such considerable influence on the effectiveness of undissolved phosphates, we must expect to find a great amount of contradiction in the results of field experiments carried out in different places, and in different seasons; and here, at least, we are not disappointed.—R. WARINGTON.

A LETTER of R. Lanciani of Rome, in the London *Athenæum*, gives an account of excavations just made of the theatre of Ostia, and, amongst other matters of great interest, a glimpse of the way in which the movement of grain was managed by the old Romans. It is found that the theatre had been rudely re-built in the fifth century, but the building materials as well as the decorative have been stolen from other monuments of the town. This last-named practice explains the magnificent results of the excavations. We have found, for instance, the walls of the corridor leading into the orchestra built with rows of marble pedestals, placed lengthwise, and joined together with iron bars. These pedestals, sixteen in all, once supported the statues of distinguished citizens in the Forum, and are inscribed with eulogiums of their merits and exploits. The importance of such records cannot be overrated. Most of the men on whom the honour of a statue had been conferred were Roman knights, and had distinguished themselves all over the Roman Empire, fulfilling important duties in the provincial administrations. One of them, Quintus Acilius Fuscus, is said to have been *procurator annonæ trium Augustorum nostrorum Ostiis*, the three Augusti being Severus, Caracalla, and Geta. After the murder of Geta his initials were erased from the pedestal, and the sigla AVGGG-XXX changed into AVGGNFC, the FC meaning *procurator*.

The Prefect of the Annona in Rome had representatives in every province of the empire, which sent the surplus of its harvest to the metropolis; hence we find "*procuratores annonæ*" in Southern France, in Spain, in Sicily, in Africa. It is well worth noticing, as a comment upon Lloyd's statistics of vessels reported as missing during the past year, that in ancient times grain was not shipped in

bulk. Ostia, being the seaport of Rome, and the focus of the breadstuffs trade of the world, was under the supervision of a special "*procurator annonæ Augusti*," whose duties were to certify the regularity of shipments and the good condition of cargoes, to store them in the government granaries at Ostia or else to forward them to town, and so on. Most certainly he did not enjoy a sinecure. Egyptian shipments alone exceeded the yearly amount of seven hundred million litres of grain; Sicily, Numidia, Africa propria, Cyrenaica, and Sardinia followed suit. The aggregate area of the port of Claudius and of the dock of Trajan amounted to 1,082,788 square metres, with four kilometres and a half of quays! I may add that under favourable circumstances vessels sailing from Ostia could reach Alexandria in eleven days, the Straits of Gibraltar in seven, the Straits of Messina, and sometimes even the coast of Epirus, in five, the coast of Spain in four, the coast of France in three, and Africa in less than two days.

On Monte Mario the hypogeum of a tomb was found, containing the beautiful inscribed pedestal of a lady who died at the age of 12 years 11 months and 7 days, Marcia Maecella, daughter of C. Minicius Fundanus, A. D. 107. "I feel deeply sad," writes Pliny, "for the loss of the younger daughter of our Fundanus, a charming, lovely girl, worthy not only of a longer life, but almost of immortality. Although not yet fourteen years old, she showed the quietness and the gravity of a matron with the suavity and modesty of a virgin. How sweet it was to see her embracing her father, welcoming her father's friends, loving her governess and her teachers! In the course of her sickness she confidently gave herself up to the care of physicians, and tried to keep up the spirits of her elder sister and of her father by fighting courageously against the violence of the malady. She was already betrothed to a young gentleman of her choice; the day of the wedding had already been settled; we had already received our invitations . . . and now, what a terrible change! I cannot tell you how sally despondent I felt when I heard Fundanus himself ordering that all the money set aside for her *trousseau* and jewellery should be spent in the funeral ceremonies."

THE Nova Scotia Tile Drainage Bill, introduced by Colonel W. M. Blair, M.P., for Colchester, is published for public information. We presume it will come up for discussion in the House next winter.

RADISHES must be grown quickly or they will be tough, stringy, and bitter. If forced by a daily sprinkling of liquid manure they will be very brittle and tender.