mineral phosphates and of organic nitrogen and phosphorus compounds in soils.

The Pedology Department is closely linked with the Soil Survey and, in collaboration with the latter, a study has been made of the mineralogy of sand and clay fractions from a wide range of soils from Great Britain and the Colonial Territories. This work is providing important data on soil formation and classification. Progress is being made with the survey of trace-element distribution in British soils, and work continues on the effects of leaf leachates in soil-forming processes.

Investigations on the possibility of controlling disease fungi by antagonistic micro-organisms are in progress in the Soil Microbiology Department. It has now been shown that the action of Actinomycetes in suppressing the root fungus *Helminthosporium* is antibiotic and not merely competitive. Work continues on the strains of clover nodule bacteria which fail to produce effective nodules, and attempts are being made to select genetically stable strains for seed inoculation.

Studies in the Botany Department include the mutual interaction of iron and other micro-nutrients, the uptake of nutrients by plants through the leaves and by excised roots, and the physiological effects of virus infections. Work on kale has shown that there is an optimum leaf area, per unit area of land, for dry-matter production. If this is exceeded, efficiency falls off due to the mutual interference of leaves. Studies on weeds continue, with special attention being paid to wild oats.

The Biochemistry Department is mainly concerned with the study of representative enzyme systems, special attention being paid to the enzymes of bracken in the hope that measures of control may ultimately result. Various oxidation systems are also being studied, and progress has been made in designing a press for the large-scale extraction of protein from fresh leaves.

Work in the Plant Pathology Department seems to indicate that, in newly inoculated leaves, virus particles are continually synthesized and broken down and that the ratio of breakdown to synthesis increases with temperature. Among much other interesting work on virus diseases, it has been shown that the incidence of yellows in sugar beet is much reduced by systemic insecticides. Mycological studies have been carried out in relation to a number of crops, and the value of soaking sugar-beet seed in ethyl mercury phosphate has again been emphasized.

In the Nematology Department intensive study is being made of eelworms, their relationships to host plants and the conditions under which populations build up. Surveys at Rothamsted show that increases of eelworm cysts on plots under continuous mangolds and sugar beet have been very slight during the past eight years, but that the highest densities are associated with manurial treatments giving the highest yields.

Research has continued in the Insecticides Department on the mode of action of organo-phosphorus insecticides and, in particular, on their interaction with the esterase systems of various insects. Useful work is reported on practical methods for controlling black aphid on beans and the wheat bulb fly, and progress has been made in rearing the latter in the laboratory.

The biology of the wheat bulb fly is also being studied in the Entomology Department. Work continues on the dispersal of aphids and on the biology

of their natural enemies. Interesting studies of gall midges of various plants are reported, in particular the Hessian fly and the midges of white clover, the latter being especially important in relation to the production of clover seed.

The Bee Department once again presents a fascinating research report on foraging habits and social organization. It has been shown that the foraging of bees may be induced by the release in the hive of a scent which they have learnt to associate with food, and this may have great importance in problems of directing bees to particular crops. The sharing of sugary substances collected by one bee with the other members of a colony (using syrup containing carbon-14), the nature and functions of 'queen substance' and trials of acaricides are among other studies reported.

An electronic computer has now been installed in the Statistics Department, and an intensive study is being made of its potentialities. The survey of hill and livestock-rearing farms is complete and will indicate what scope exists for further expenditure on upland farms. Surveys of fertilizer practice and rabbit damage continue.

The report closes with two useful review articles on "Clay Minerals" and on "The Uptake of Nutrients from Leaf Sprays by Agricultural Crops".

EAST MALLING RESEARCH STATION

REPORT FOR 1954

THE forty-second annual report, for 1954, of the East Malling Research Station, near Maidstone, Kent (170 pp., 12s. 6d. post paid from the Station), includes two general papers of particular interest. The first is the text of the seventh Amos Memorial Lecture, by Prof. T. A. Bennet-Clark, who reviews various concepts of the mechanism by which water ascends large trees, showing that this is not yet fully understood, and makes a plea for more research on the matter. The second is by S. C. Pearce and D. W. P. Greenham, and is a history of the Station's land in the parish of East Malling. It has been possible to trace certain land uses as far back as A.D. 1411, and such historical investigations might achieve useful correlation with modern soil survey.

Malling types of apple rootstocks are now famous, and H. M. Tydeman gives a most useful summary of the twenty-four types, and also crab *C*. His text is very short, but five tables and thirty-five excellent half-tone illustrations give very detailed information about winter and summer characters. D. W. Way, E. S. J. Hatcher and R. J. Garner have investigated the propagation of rootstocks by means of root cuttings. Position on the original root system, length, moisture relations, depth of planting, and various methods of coating the cut ends, have all been assessed, and detailed results are presented. The two last-mentioned workers have also experimented with propagation of Malling crab *C*, by sphæroblast cuttings. Sphæroblasts are rounded swellings on woody stems which are able to produce shoot buds—sufficient to yield some twenty-five hardwood cuttings per maiden tree. The peach variety Hale's Early is compatible with a Brompton rootstock, though not

with Myrobalan *B*. Barbara Mosse shows that on a tree successfully established on a Brompton rootstock, incompatibility was induced by ring-grafting the Brompton stem with Myrobalan *B* bark, and the histology of the union is described. Papers on varietal performance and fruit management include two papers by A. P. Preston, on the results of variety trials of black currants over seven years, and an assessment over nine years of two systems of pruning the crop. Dorothy J. Wilson has measured the loss in yield due to the genetic conditions of Auchincruive Climax known as transient yellows and 'streak'. M. M. McNeill finds that apples grown in pots under glass require applications of dried blood to supplement the normal John Innes potting compost. D. W. Way and G. H. Freeman have bravely undertaken a very careful tasting trial of strawberries and raspberries, with results which are, nevertheless, somewhat of a surprise—at least to the present writer. Temperatures during night frosts were higher over compacted ground than over loose soil, according to C. H. W. Slater and J. P. Ruxton.

It is important that materials for the control of pests should not themselves cause damage, but H. W. B. Barlow, G. H. L. Dicker and J. B. Briggs found that parathion sprays against apple sawfly caused marked fruit drop. Yet parathion gave more significant increases in yield than gamma-benzene hexachloride and nicotine. Such increases were not due to control of the sawfly, and the mechanism by which they were obtained requires further investigation. H. W. B. Barlow, C. R. Hancock and H. J. Lacey have isolated certain heat-stable growth-inhibiting substances from woody shoots of crab *C* and Myrobalan *B* rootstocks. Changes in mineral nutrients in the leaves of the 'biennial bearer' apple Miller's Seedling were investigated by A. C. Mason, who has shown that larger concentrations of nitrogen, phosphorus, magnesium, calcium and manganese occur in the fruiting years than in the non-fruiting ones. A laboratory study by E. L. Frick of thirty materials for their relative ability to inhibit spore germination of *Botrytis cinerea* brought out some interesting divergencies between laboratory and field performance. Two of the substances—tecnazene and pentachloronitrobenzene—are already in use against the fungus, but did not inhibit spore germination. Thiram and the ferric, zinc and manganese dithiocarbamates, moreover, inhibited spore germination at two different concentration ranges.

Leaf roll, a new virus disease of the sweet cherry, is described by A. F. Posnette and R. Copley. An attempt to clarify the relations between nettlehead and split leaf blotch viruses of hops has been made by J. T. Legg. Evidence for the view that the latter is a component of a complex causing the former is as yet inconclusive; but in this particular field trial, the relevant clones of College Cluster and Malling Midseason had the lowest amount of nettlehead of any variety tested. A. M. Massee contributes fifteen short notes on interesting insect records in 1954, perhaps the most important of which is an attack by cockchafers in two localities. He also reviews problems arising from the use of insecticides, and makes a plea for entomologists to study their effects upon the whole orchard fauna. Joan R. Groves reports that mercury-vapour light traps were found more efficient than bait traps for catching codling moths, while D. A. Chant and R. C. Muir find that the brushing machine method is superior to the imprint method for estimating numbers of fruit-tree

red-spider mites. In the realm of statistics, G. H. Freeman and Margaret J. Hall point out that variations in number of red-spider mites from leaf to leaf, between trees, and also between plots, should all be considered when estimating the significance of control treatments.

There are, in the report, also accounts of all the activities of research sections and a description of the organization of the experimental farm. There are weather records and the texts of three bulletins for fruit-growers: on the search for better fungicides, by M. H. Moore; an illustrated description of capsid bugs, by Elsie Collyer; and on some impressions of apple orchard practices in Canada, by G. H. L. Dicker and A. H. M. Kirby. The volume is produced to the usual high standards of printing and illustration, and—most welcome—there is an index.

JOHN GRAINGER

PATHOLOGY OF BIRDS IN ZOOLOGICAL GARDENS

A STUDY of the pathology of birds in the Zoological Gardens of Antwerp has been made by Prof. L. M. G. Geurden, of the University of Ghent (*Bulletins de la Société Royale de Zoologie, d'Anvers*, No. 4).

Bird diseases in zoological gardens are numerous and mortality is very high. The primary cause may be either in the country of origin or in the transportation, or in the zoological garden itself. In captivity, malnutrition, deficient food or lack of movement influence a large number of birds, although their susceptibility varies within wide limits from one individual to another.

In the period under review, Prof. Geurden dissected thirty-five dead birds; a laboratory analysis was often required for a definitive diagnosis. The most common causes of death were pneumonia (5), visceral gout (13) and hæmorrhagic enteritis (22). Pneumonia, quickly followed by death, is common in birds originating from tropical countries when exposed to low temperature. Isosporosis involving a primary disease is likewise very frequent. Captive birds often suffer from visceral gout; the great change in the way of living and in the nature of the food is doubtless the starting-point of this disease, although the susceptibility of different individuals varies considerably. Diseases such as cæcal coccidiosis and black head will affect all members of the gallinaceous group in the same way.

The majority of birds had died from hæmorrhagic enteritis. In the absence of intestinal parasites, the bacteriological test for detecting *Salmonellae* often shows a negative result. *Salmonellae* were cultivated seven times from the intestinal contents.

Birds are commonly considered as the biggest reservoir of *Salmonellae*; powdered eggs used during the War have shown this on a very large scale. In some cases latent infections occur, in others acute diseases develop. Although several internal organs may be the seat of these infections, they are more often found in the intestines and in the genital organs. Owing to the large number of *Salmonella*-types, the epidemiology of *Salmonella*-infections is quite confused, and, in his work, Prof. Geurden clarifies a number of points which have previously caused difficulties with various species and types.