ROTHAMSTED RESEARCH

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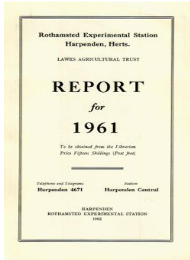
Full Table of Content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Field Experiments Section

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resolving power, for pictures showing resolution of the 1·0-mμ order can easily be obtained, and it seems unlikely that the sub-units of all the other viruses studied are smaller than 2–4 mμ in diameter. Lack of contrast appears to be mainly responsible, for when structure is seen in turnip yellow mosaic virus it is often visible only in pictures taken under conditions providing maximum contrast, and it disappears when the current in the objective lens is raised to provide the sharpest possible image. Attempts are now being made to improve this state of affairs by altering the staining techniques, but it is not yet possible to exploit to the full the potentialities of particle morphology as a basis of virus classification. However, we already have pictures showing that groups of viruses with similar biological and physical properties also have particles that resemble each other in the electron microscope, and the visible similarities and differences are often big enough for a trained observer to place an unknown virus preparation in the correct group with some confidence. (Nixon, Gibbs and Woods.)

A new virus from cocoa

When completed this work will describe the symptomatology, host range, transmission, purification and properties of a previously undescribed virus isolated from cocoa. The particles resemble those of turnip yellow mosaic virus and wild cucumber mosaic virus; preparations contain two components, one of which seems to be free from nucleic acid and non-infective. (Nixon, Gibbs and Woods, in collaboration with R. H. Kenten, West African Cocoa Research Institute, Tafo, Ghana.)

Clover yellow mosaic virus (CYMV)

This virus has as yet been found in clovers only on the west coast of North America. Electron micrographs of the virus, prepared by the cut-leaf method from infected *Gomphrena globosa*, showed that its particles are flexuous rods 520–530 mμ long. Serological tests by us and by Dr. M. J. Pratt (Vancouver) failed to show any relationship between CYMV and potato aucuba mosaic (580 mμ), and CYMV was not transmitted by *Acyrthosiphon pisum* from plants infected with CYMV alone or in combination with pea mosaic virus or bean yellow mosaic virus. (Gibbs and Woods.)

Carrot motley dwarf

This disease was widespread in England and ruined most carrot crops sown in April or May, but was less damaging in crops sown later. It is spread by the aphid *Cavariella aegopodiae*, which was caught on the sticky trap at Woburn between 8 May and 28 July. The maximum catch, 609/sq. ft. of trapping surface, was in the week 17 to 26 June. Attempts to control the disease and to measure yield losses at Woburn did not fully succeed, but spraying three times with " Metasystox " starting 5 June, increased the yield of roots from a crop sown on 16 May from 3·5 to 6·6 tons/acre. Spraying three times starting 27 May had less effect with a crop sown on 13 April, increasing yield from 6·1 to only 7·1 tons/acre, probably because the crop was exposed for so much longer than the later-it was alone or in mixed infections with potato virus Y (PVY). Aphids (10 per test plant) did not transmit PAMV to tobacco or pepper from plants infected by it alone, but did readily from plants infected with PVY. Serological tests for PAMV and PVY showed that some of the tobacco test plants were infected with PAMV alone, some with both viruses and some with PVY alone. PAMV was transmitted only when aphids fed for less than 1½ hours on infected plants. Exposing infected leaves to ultra-violet radiation prevented aphids from becoming infective. (R. Close.)

Soil-borne viruses

Grapevine viruses. Viruses from Portuguese grapevines with diseases of the yellow mosaic type or the fanleaf type were transmitted by inoculation of sap to thirty herbaceous species in five plant families. The two types of isolate produced similar symptoms in most hosts, but could usually be differentiated in *Chenopodium amaranticolor*. When transmitted back to grapevine, by grafting with infected *C. amaranticolor*, an isolate from a grapevine with fanleaf caused fanleaf symptoms, and an isolate from a grapevine with yellow mosaic caused yellow mosaic symptoms. Serological tests showed that the viruses causing these two distinct diseases in grapevines share many antigenic groups. Both viruses are distantly related to the type strain of arabis mosaic virus. (Dias and Harrison.)

Difficulty in transmitting viruses from grapevines to herbaceous plants by sap inoculation can largely be attributed to inactivation at the low pH value of sap from grape leaves. An inhibitor of infection that was active in undiluted grape-leaf sap at pH 7 was less important. (Dias.)

Nematode vectors. Scottish strains of tomato black ring virus are transmitted by *Longidorus elongatus*, and can be differentiated serologically from English strains. *L. attenuatus* was associated with a disease outbreak caused by an English strain and, when extracted from the soil and placed on healthy plants, it transmitted this strain.

Raspberry ringspot virus, too, occurs in England and Scotland in strains that can be distinguished serologically. *L. macrosoma* occurred at disease outbreaks in raspberry and blackberry in England, and it transmitted the English strain of the virus in glasshouse experiments. (Harrison.)

Control measures. Nematicide experiments, made in collaboration with J. E. Peachey (Nematology Department), showed that methyl bromide and " D.D " both control the virus vector *Xiphinema diversicaudatum*, and that these chemicals have promise for preventing the spread of arabis mosaic virus. Other chemicals, and varying the method of application, are being tested. (Harrison.)

Structure of small polyhedral virus particles

Internal structure can be seen in electron micrographs of one group of viruses with similar properties (turnip yellow mosaic, wild cucumber mosaic and a virus recently isolated from cocoa), but not in other groups. This failure cannot be explained by lack of

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with a yield of 26·4 cwt., was also better than usual, but not to the same degree.

Barnfield

All the standard manures and fertilisers were applied in spring, and the field was bare fallowed for a second season in preparation for a new scheme of diversified cropping, in which mangolds will be one of the crops, thus maintaining a connection with the old experiment. Lawes and Gilbert's classical " mineral " treatments will still be laid along their strips, but the individual plots will be subdivided to test levels of nitrogenous fertiliser.

Exhaustion Land

The poor appearance of the plots that had received no phosphate in former years is often very striking in the early stages, but in 1960, and again this year, it was difficult to pick them out in spring. When the crop came into ear, however, plots having dung or phosphatic residues looked slightly thicker than the rest, and were obviously more forward. The land was very clean, except for some couch (*Agropyron repens*) that had survived two years' treatment with dalapon.

The Rothamsted Ley–Arable Rotation Experiment

by D. A. Boyd, G. W. Cooke, G. V. Dyke, J. R. Moffatt and R. G. Warren

Description of experiment

There have long been differences of opinion on the value of ley farming, especially in the Midland and Eastern Counties of England. To decide whether the additional costs implicit in a policy of " taking the plough round the farm " are justified by increased production per acre, we must be able to compare the productivity of land solely under arable crops and permanent grass with that of similar land devoted to a system of alternate leys and arable. The Rothamsted ley–arable experiment was designed for this purpose. In making the comparison, the production from the grassland and arable land of these two farming systems can be treated separately, and our report is mainly devoted to the yields of arable crops in different rotations, which are simpler to compare. They are perhaps the more meaningful, because very few combinations of types of sward, methods of use and management can be tested in a single experiment, and even these few may be somewhat artificial, because it is difficult to simulate normal practice when grazing small plots.

The experiment, which began in 1949, is in two parts; one is on Highfield, which was in very old permanent grass and had accommodated a grazing experiment in the period 1937–48; the other part, on Fosters field, had been arable for many years. Cropping is the six-course rotation shown in Table 1, the first three courses of which consist of grazed or conserved ley, lucerne or arable crops, followed by three " test " crops, wheat, potatoes and barley, which are common to all four rotations. In addition, there are permanent grass plots sown down at the beginning of the experiment, and, on