COMA cluster are consistent with a model in which a hot, intercluster gas receives its energy from heating inside the individual active members of the cluster (see Serlemitsos *et al. Astrophys. J. Lett.* **211**, L63; 1977 for experimental data; Yahil *et al Astrophys. J.* **185**, 787; 1973 for theoretical discussion). Cosmic ray heating could well be the relevant non-thermal process feeding the intercluster medium through enhanced galactic winds. □

Forecasting in crop protection

from R. Hull and C. R. B. Baker

The Second Conference on Forecasting in Crop Protection was held in Paris on June 21–24 by the European and Mediterranean Plant Protection Organisation.

THE ability to forecast reliably the timing and intensity of pest and disease attack on crops is crucial to reducing unnecessary and undesirable use of pesticides if at the same time agricultural productivity is to be maintained and improved. This claim was made for many national forecasting schemes described at the conference, which covered national forecasting organisations, meteorology, field monitoring methods for pests and diseases, interpretation of pest and disease counts, development of forecasts, and the link-up with the growers.

Schemes of varying sophistication were outlined. They ranged from a computer-based system organised by Michigan State University in the US, through national networks of observers and warning stations operated in countries such as France and Hungary, to systems designed to provide warnings of a specific pest or disease. Techniques on which forecasts are based include monitoring pests and diseases by sampling crops, trapping insects in pheromone traps and in tall suction traps that sample the migrant fauna in the air, observations on caged pests, observations on plots of appropriate crops maintained at regional forecasting centres and the use of meteorological data. In most countries such schemes are operated by government agencies or are subsidised by government funds. Since the activity of all organisms damaging crops is influenced in one way or another by weather, much attention was given to recording and interpreting meteorological data in relation to phytopathological problems.

Means of communication with farmers and growers included postal warnings, radio and television broadcasts, telephone answering services, public notices and personal contact. Although delegates seemed convinced that their own national schemes were making some impact on farming practice, especially in reducing use of pesticides, little quantitative evidence was presented that pests and diseases were being controlled more efficiently or that the forecasting schemes were economic. It was emphasised that forecasts were generally issued to cover a region and cannot be detailed enough to show the local variations that affect the individual grower. He needs local advice or further education so that he can make his own judgement based on the growth stage of his own crops and the actual stage and abundance of the pests or diseases present and also sometimes of their natural enemies.

Several speakers stressed the need for a thorough knowledge of the biology of pests and diseases, but important gaps in such knowledge were evident throughout the conference. In particular there was a lack of a coherent picture of differences in pest behaviour across Europe. Standardisation of assessment methods as recommended in the FAO manual on Crop Loss Assessment Methods was discussed.

Agricultural research and advisory services have been operating in most developed countries for several decades. It was clear from this conference that despite all the effort applied so far, problems in pest and disease management continue and that forecasting is an essential part of any ultimate solution. Unless flexible, the best devised research and advisory programmes could be nullified by a change in agricultural practice, such as that from ploughing to direct drilling.

The conference made two proposals for follow-up action under the aegis of EPPO. First, a working party should be convened to appraise the various systems of assessing and forecasting crop losses. Second, closer cooperation should be organised between meteorological and plant protection services in the collection, dissemination and use of meteorological observations in relation to the needs of crop protection. □

R. Hull has just retired as Director of Broom's Barn Experimental Station, Harpenden; C. R. B. Baker is an entomologist at the Plant Pathology Laboratory of the Ministry of Agriculture, Fisheries and Food at Harpenden.

Tree-ring dating in Britain comes of age

from a Correspondent

The first International Symposium on Dendrochronology in Northern Europe was held at the National Maritime Museum, Greenwich, London from 11 to 14 July, 1977. The papers will be published by *British Archaeological Reports* (112, Banbury Road, Oxford OX2 7BP) in collaboration with the National Maritime Museum and the Research Laboratory for Archaeology and the History of Art, University of Oxford. A companion exhibition, instigated by Dr J. M. Fletcher (University of Oxford), on tree-ring analysis of Tudor portraits is open at the National Portrait Gallery, London until 18 September 1977.

IN the historic setting of the National Maritime Museum close by the Royal Observatory, Greenwich Park—long famous for the measurement of British Standard Time—the precise measurement of the annual growth rings of trees for dating purposes was shown at the meeting to be an interdisciplinary and international subject with great potential for European environmental science and archaeology. Dendrochronology, although not yet a commonplace technique, already is shedding light on such wide ranging subjects as past climates, sea level changes, tree ecology and forest management in prehistoric and historic times, and is proving an invaluable aid in dating of archaeological remains and in art history.

Holding the meeting in London was particularly important for until the past 10 years or so little research on tree-ring analysis has been done in Britain, although some pioneering work was done in the 1940s and 50s by Lowther and Schove. This slow start may be explained partly because of the difficulty of devising suitable reference chronologies for oaks growing in southern and eastern England, but also partly by unfamiliarity with the classical German and Russian work on the subject.

The problem in the development of tree-ring analysis in north-west Europe has been that the growth of deciduous trees and thus the pattern of annual rings is more variable in temperate regions than in the semi-arid and arid areas of south-west USA: site conditions (such as altitude, and soil), defoliation by insects and man's influence may affect tree growth in Europe as much as temperature and rainfall—the predominant