

studies, Northampton College of Advanced Technology, London, and Mr. Z. M. T. Tarkowski, adviser on training, and special lecturer in management studies, Northampton College of Advanced Technology, London, who have done a considerable amount of work in this field.

The South London Committee convened a Case Study Group, at the meetings of which, at monthly intervals, various case studies were considered. The bulk of those so far discussed were from a series produced by Mr. Tarkowski, which give a representative sample of management situations, each in a typical British context. The way discussion went was analysed afterwards, under the leadership of Miss Turnbull.

The wisdom of selecting this approach became apparent early on in the series of meetings of the Group. Postmortems brought out the many inter-related points which have to be recognized and brought to bear on each other by the chairman. The effect of the size of the group, of a time limit, of the extent of the previous experience of the use of case studies, the attitudes of members, the need for the leader to draw members into the discussion and to encourage cross-fertilization of ideas without imposing on the group, are some of the many points which were discussed and which call for skilful leadership.

The reaction of the group depended upon the nature of the case study. If, at first sight, a specific management problem was apparent, or if the case study described a dramatic situation, such as a conflict of actual decisions taken, there was a tendency to examine the obvious problem and to suggest a satisfactory line of action which could be the next step to be taken in the situation. Where the management problems were more intangible and demanded

a deeper analysis of individual characters, and of the situation, the more limited approach was replaced by a broader consideration of the personalities and the influences of the background in the work situation which caused a strained atmosphere. In fact, more than one problem can be isolated in these case studies, depending on the perception of individual members of a group. Practice in this type of analysis gave more satisfaction to the members of the Group. At the last meeting held, a case study already previously discussed was re-examined, and comparisons were made with the first discussion. These brought out the wide range of issues which can be illustrated by a single case study, and how diverse two discussions of the same case study can be.

Co-operating with Mr. Tarkowski and Miss Turnbull, several members of the Group have appeared as 'characters' in case study exercises held as part of a course at the Northampton College of Advanced Technology. The object of these exercises is to make the case studies more vivid and realistic, to bring out subtle issues of verbal communication and to give members of the group practice and experience in day-to-day interviews and conversations, which form a large proportion of a manager's work. So far as is known, no course on quite similar lines has been developed elsewhere.

The South London Committee has now arranged a week-end conference on "Research Necessary for the Preparation and Use of Case Studies: Some Recent Work and Prospects for Further Developments in Great Britain", to be held during October 7-9 at the British European Airways Staff College, East Burnham, Slough, Bucks. Further information can be obtained from A. E. Hout, South London Branch, British Institute of Management, c/o Management House, Fetter Lane, London, E.C.2.

## THE RESEARCH COUNCIL OF ALBERTA

THE fortieth annual report of the Research Council of Alberta, covering the year 1959, contains lists of advisory committees and their membership and of the staff of the Research Council besides a list of publications for the period 1955-59 (pp. v+54. Report No. 79. Edmonton: Research Council of Alberta, 1960). During the year, programmes on geology, ground-water and soils were brought together in an "Earth Sciences Branch", and work on coal, petroleum, natural gas and gasoline and oil testing in a "Fuels Branch". The ground-water studies are providing basic information on the ground-water resources of Alberta, and have offered substantial annual savings of water costs, for example, from the research on charging of water from Driedmeat Lake into a nearby gravel terrace. In surface geological mapping in the Taber area a buried Indian camp site was uncovered in the valley walls of the Oldman River, and along with Indian artefacts the skeleton of a buffalo and a willow branch were found, for which radiocarbon dating gave an age of 11,000 years. The Geological Division has developed a mineral dressing laboratory with the special purpose of investigating the possibility of refining Alberta sands. Studies of Cretaceous stratigraphy have been expanded into a co-ordinated programme, and a sub-surface study of Lower Cretaceous strata of central Alberta is in progress with the purpose of

establishing the interrelations of the marine and non-marine zonations. Upper Cretaceous beds in the Peace River region have been zoned micro-faunally, and the southward marine extension of these strata is being examined for micro- and macro-faunal content.

The Coal Division is continuing an investigation of carbonization, which during the year has shown that the carbonization reaction is much faster than was thought, and the overall reaction is only slow because the coal-tar products have difficulty in working their way out of the carbonaceous residue; the overall reaction can be accelerated considerably in presence of nitric oxide. The Natural Gas Section is examining a process for recovering helium from natural gas, and the Petroleum Division discovered that mud from the bottom of a local lake contained completely developed petroleum pigments along with traces of other oil materials. Pilot plant experiments were extended to work on a concentric flow of heavy oil and water mixtures in a 1,000-ft. experimental pipe-line, which showed that injection of about 30 per cent of water gave a pressure drop of up to about 75 per cent. The Industrial Engineering Services Group has made good progress in studies on carburation to permit the satisfactory use of propane and butane as engine fuels. Studies have been commenced on the effects of various solvents on plastic

pipes, and a 500-ft. length of buried pipe carrying natural gas is now being observed under actual operating conditions.

Satisfactory progress is also reported in the high-way research programme. The co-operative cloud physics and hail research programme is now in its fourth year, and the results should indicate whether Alberta hail is generally similar to that studied in Europe or whether there are significant differences in structure. The special weather-radar continues to give much information on the cloud systems moving

through the area, and a meso-network of some thirty microbarographs has now been arranged at intervals of about 10 miles. Preliminary results from the study of nucleation represent a major advance in the basic approach to the hail problem, and following the study of nucleation commenced last year at McGill University, the work was continued during the summer with the project group at Penhold, where a method of determining the amount of 'freezing nuclei' in rain-water, or water obtained from melted hailstones, was applied.

## ROTHAMSTED EXPERIMENTAL STATION

F. C. BAWDEN, whose style of writing could profitably be copied by directors of other research institutes, states in his annual report for 1959 of the Rothamsted Experimental Station\* that the ultimate aim of agricultural research must be to increase the efficiency of agriculture by lowering unit costs of production and improving the quality of the produce. The very wide range of activities described in this report offers scope for assessing the contribution of Rothamsted towards this goal. Whether this aim will be better served by the empirical approach of much of the work reported, or by the establishment of general principles formulated on research of a more fundamental nature, is obviously a question which must exercise the mind of any good scientific leader. Perhaps the best compromise is to encourage developments along both lines, the correct allocation of resources depending on many factors.

There is no question that the work on the use of fertilizers, irrigation, and the control of weeds, pests and diseases has the immediate practical aim of increasing agricultural efficiency; but there is plenty of evidence throughout this report of more academic inquiries covering such varied matters as the underground activities of organisms as diverse as slugs, earthworms, fungi, nitrogen-fixing bacteria and an eel-worm that transmits a soil-borne virus; the internal structure of viruses and the relative infectivity of intact virus particles and their separated nucleic acids; the activities of enzymes in insects, bacteria and leaves; the biology of weeds and the relation between the potassium supply of soils and the nature of the clay minerals.

In the Chemistry Department, where work on fertilizers has always loomed large and has been responsible in no small measure for the present high efficiency of arable crop production in Great Britain, much basic work is now proceeding on soil organic matter, nitrogen, phosphorus and potassium. It might fairly be said that soil fertility studies at Rothamsted have suffered in the past from the 'NPK' (nitrogen-phosphorus-potassium) complex; but attention is now being directed towards other elements such as magnesium and molybdenum. Judged by the increasing incidence of hypomagnesaemia in farm animals, this interest is timely or even late, and if the work on micronutrients merely indicates that deficiencies of such elements are likely to be rare in Britain, it will serve its purpose.

Biochemistry increasingly emerges as the central discipline in agricultural research; and its impact can be seen in many departments ranging through soil chemistry, botany, pathology, insecticides and fungicides. In the Biochemistry Department itself, work is concentrated on plant enzyme systems, but there is some collaborative work with the Nematology Department on eel-worm hatching factors. One wonders whether the work on the extraction of protein from leaves has not now served its valuable purpose and should be handed over for large-scale development to industry and governments in countries where malnutrition is still a serious problem.

Russian claims that inoculation of soil with *Azotobacter* increases crop yields have been treated with scepticism in the Western world. None too soon, these reports are being properly investigated by the Soil Microbiology Department, and under some conditions, at present ill-defined, inoculation has increased yields significantly.

One of the dangers when a research station reaches the size of Rothamsted is that each department may work on isolated problems when more progress is likely to be made, particularly in biological research, by inter-departmental co-operation. There is disappointingly little evidence of this collaboration where it might be most valuable, for example, between the Chemistry Department, Pedology Department and the Soil Survey of England and Wales. That such co-operation is possible and fruitful is evidenced by the work of the Macaulay Institute in Scotland. On the other hand, it is pleasing to see the Botany Department is studying the effect of soil-water deficit on plant growth, clearly complementing the work in soil physics, where the study of agricultural meteorology, which has already had a notable effect on the practice of irrigation, is being extended into the field of micro-meteorology.

There is an encouraging sign of collaboration in the report of the Entomology Department. Changes in soil fauna brought about by long-term bare-fallowing are being studied, and at the same time other departments will study changes in soil organic matter, microflora, physical properties, organisms causing crop diseases, nematode populations, and the survival of weed seeds. Perhaps this will be the forerunner of other co-operative work, and for a start one might suggest similar studies when land is put down to grass. After all, grass is still the most important crop of Britain, and unless the Agricultural Research Council objects to duplication of effort, it would be stimulating to see Rothamsted paying more attention to grassland soils and some of the problems of herbage production.

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\* Lawes Agricultural Trust. Report of the Rothamsted Experimental Station for 1959. Pp. 288. (Harpenden: Rothamsted Experimental Station, 1960.) 10s.