OBITUARY NOTICE.

EDWARD MORTIMER CROWTHER.

1897—1954.

AGRICULTURAL chemists in many countries will learn with regret that Edward Mortimer Crowther of the Rothamsted Experiment Station died of heart trouble on March 17th, 1954, at the Dunstable Hospital, Luton, after a very brief illness. He was born at Horsforth near Leeds on April 15th, 1897. Starting at an elementary school he gained scholarships first to Archbishop Holgate's School, York, and then in 1914 to Leeds University where in 1917 he took an Honours degree in Chemistry. Strongly objecting to military service he was assigned to the Rothamsted Experimental Station, then engaged on the difficult task of helping to produce more food in Great Britain under the severe handicap of heavily curtailed supplies of skilled labour and of fertilizers. Munition makers had the first claim on ammonia, nitrates, and the sulphuric acid needed for making superphosphate; there was as yet no synthetic nitrogen industry in this country; the only source of ammonia was from coal; nitrate and sulphur both had to be imported at heavy risk of loss by submarines. Food supplies from overseas were being sunk daily and the position was serious.

At Rothamsted Crowther was attached to a small group searching for fertilizer materials among the waste products of industry and of the cities. He proved so able and trustworthy that at the end of the war he was appointed permanently to the staff.

The war had shown how greatly science could help agriculture and after it was over Rothamsted received substantial grants for expansion. It was, however, necessary to make fundamental changes in agricultural science itself. Hitherto it had been regarded as a branch of chemistry; as it developed it had to be linked with the physical and biological sciences. An ill-defined hybrid subject, descriptive only, might have resulted, but the policy adopted at Rothamsted was to put it on a firm quantitative basis, aiming at as high standards of accuracy as possible. A statistical section was set up under R. A. Fisher and principles of experimentation were worked out which allowed the probable error of each experiment to be calculated and also enabled plans of experiments to be devised in which the error should be within a specified limit. The men and women selected to work on these lines had to be, not only well trained in their science, but also sufficiently receptive mentally to be able to assimilate the new principles and to base their investigations on them. Crowther satisfied these conditions extraordinarily well.

He was put into the new Physics Department under B. A. Keen and began by studying the methods of determining soil acidity, a condition then attracting much attention because of the losses of crop resulting therefrom. Various titration methods had been devised for its estimation, but doubts were arising whether any of them was adequate : Crowther confirmed the view that the hydrogen-ion concentration must be determined and he devised a practicable method bywhich this might be done simply and with sufficient accuracy. Recognising the value of one of the titration methods for a busy analyst he showed how it might be used to the greatest advantage, and with what limitations. This work led to a study of the various liming materials.

He also studied some of the colloidal properties of soils. It was then generally assumed that the particles of the soil were coated with a colloidal gel which gave it some of its special properties : he showed however that some of the phenomena could be explained by postulating a system of micropores or capillaries in the soil, and also that the colloidal portion had a reticulate structure possibly analogous to that of silica gel.

In 1923 the Empire Cotton Corporation established a soil research post at Rothamsted and Crowther was the obvious man to fill it; later he spent six months (1925—26) at Wad Medani in the Sudan to study the difficult problems arising out of the irrigation of the very heavy Gezira soil on which the valuable long-stapled cotton was grown. He retained his association with this great project all his life.

He was probably best known for his studies of the chemical aspects of soil fertility, and in particular for his attempts to estimate the fertilizer requirements of crops by chemical analysis of the soil. The last problem was an old one, but little progress had been made with it because of the dearth of precise field experiments for the standardisation of the methods. When Fisher's new principles were enunciated Crowther realised that they could furnish data of the kind needed; along with T. Eden and H. V. Garner he put into practical shape these new

statistical principles and made them an integral part of agricultural experimentation. It was a great satisfaction to him (as indeed to all the Rothamsted workers) to hear the distinguished physicist, Sir Harold Jeffries, declare at the British Association meeting of 1953 that, thanks to these new methods, " the standard of presentation of results in agriculture is better than in any of the so-called exact sciences; " adding also " this is a state of affairs that physicists should cease to tolerate."

When the Government decided to encourage the growth of sugar beet in this country Rothamsted was asked to carry out extensive fertilizer trials. These were started in 1926 under Crowther's direction, in co-operation with the factory organisation, and they were planned on the new lines so as to give the growers the information they needed, and at the same time provide the chemist with the standardised plots of soil he had long wanted. The experiments are still continuing; unfortunately Crowther did not complete the examination of the results, but the data are fully recorded. Other crops came under experiment, not on the same scale but equally well-designed; the plan also included where necessary systematic chemical studies of the produce and of the soil. He was never satisfied with what he called the crude yields.

Nor was his work confined to this country. In conjunction with W. B. Haines, then of the Dunlop Estates, Malaya, he organised a remarkably well-planned and extensive series of fertilizer experiments on rubber trees; and, as the result of a visit to West Africa, another set on the effects of fertilizers on the oil palm. In both instances these are by far the best experiments yet made. In recent years he had made some promising investigations of the problems of forestry plantations in this country.

He did a considerable amount of work also on phosphatic fertilizers, especially basic slag and water-insoluble calcium phosphates; this was in anticipation of the shortage of sulphur which has at times threatened to limit the supplies of superphosphate and may still be a cause of serious trouble. In view of the shortage of organic manures he made extensive studies of the fertilizer value of sewage sludges, straw, and other organic waste materials. He also initiated experiments in conjunction with G. W. Cooke on the proper placement of fertilizers in the soil to ensure their optimum effectiveness. His wide knowledge of the action of fertilizers proved of great service during the last war, and proposals for their effective use made by him and Dr. F. Yates were adopted as the basis of the fertilizer rationing scheme.

His keen searching criticism of the results obtained in his Department often delayed their full publication pending further examination of some points that had arisen and that he thought might vitiate them; this could not always be done at the time, so that much of his work remained incomplete and the accounts still rest in his files. It was a disappointment to his friends that the important investigations he started on the effect of climate on soil formation were never completed : the first paper published by the Royal Society in 1930 had shown a promising new approach and he always spoke with interest of the later studies he had made but not yet written up.

It is difficult to speak too highly of him as a colleague. He had the high moral character, the trustworthiness and integrity, that one expects from a member of the Society of Friends. Rothamsted passed through some anxious times during his years of service there, but his colleagues always knew that whatever might come they could rely implicitly on his loyalty and his unswerving faithfulness in following the course that he believed to be right.

E. JOHN RUSSELL.