

Practice with Science**

"PRACTICE with Science", the familiar motto, forms the title of the Presidential Address to the Agriculture Section delivered by Sir Thomas Middleton who curiously enough as he himself recalls presided at the very first meeting of this Section held in Dundee, the centre of the present meeting, when the Section was constituted in the year 1912, now fully twenty-seven years ago. Agriculture has during this period passed through strange and diverse vicissitudes, the epoch of the Great War, post-War upheavals, disastrous price slumps and all but stark ruin, despite, as the address points out in contrast, the great advances on the scientific side of agriculture. The address deals with some of the aspects of the farmer's position during these years, most of which are as familiar as they are baffling. One result as far as Great Britain is concerned is the fact that whereas during the decade 1831-40 the land of that country maintained a population of about 17 millions it now provides food for only about 14 millions. Examples are given from farm surveys to show that the above result is due to the unprofitableness of farming in the country. In the forty-eight years preceding 1919 in one of the farms in the survey a loss was incurred only in two years and in neither year was it a large one; in the fifteen years following 1919 there were six years of loss and the returns per acre in the period prior to 1919 were 75 per cent. greater than they were in the fifteen years following. The plight of the American farmer has been much more serious and this notwithstanding the stupendous efforts of that Government to assist farmers in many directions with the help of a 500,000,000 dollar fund placed at the disposal of the Federal Farm Board. In spite too of drastic measures to dispose of surpluses such as the burning of coffee in Brazil and of wheat in the U.S.A., the slaughtering of pigs and cows by thousands in Denmark and Holland, no relief has been in sight. Though much of this distress is due to the disturbance of normal conditions caused by the Great War, the Address calls attention to circumstances peculiar to agriculture which keep agricultural earnings low; one such is referred to as the tendency to treat food as a commodity on a different footing from other commodities on the idea that it belonged to the nation, *i.e.*, the non-agricultural consumer rather than to the land worker who produced it; the farmer's inability to restrict and adjust output to an anticipated fall in the demand is another serious handicap. American figures, indeed, show that while in a group of years of high prices 22.9 million acres were sown, in a low price period the area rose to 26.5 million acres, the price index during the two periods being 96 and 43 respectively. Conditions in the distributive trades are also such that no matter how high

prices may rise for the consumer the farmer gets very little of the advantage. Here is an interesting instance: when the 4-lb. loaf cost 5¼d. as it did in 1906 the farmer got 53% of the consumer's money, whereas with the 4-lb. loaf costing 8½d. as it does now, the farmer gets only 30% of the proceeds and even that only with the assistance of the Government subsidies. British fiscal policy cannot be held responsible for the depression in British agriculture as is often argued because other countries where a different policy prevails are faced with the same situation. Much is due to factors inherent in agriculture and the world has over a long period been fed at less than cost price, assuring that in cost we include a standard and equated remuneration for service. The subsidies and other Exchequer grants now being made to agriculture are to be regarded in this view not as doles but as deferred payments by the nation, which by implication leads to the conclusion that as long as farming continues to be an unprofitable undertaking the producers of food should be helped out by such grants.

The Address next takes up the second part of its theme, *i.e.*, the scientific worker's programme. During the past thirty years scientific research in agriculture has made great progress and the prospects are now better than ever. Sir Thomas recalls that in his first report from Whitehall he had to point out that the State grant for agricultural research was only £380; at the present time the grant from the Development Fund alone amounts to £500,000. Sir Thomas would disclaim any idea of blaming scientific workers for the enormous surpluses of food, though large increases are undoubtedly due to the activities of plant breeders, chemists, pathologists and others. In considering how best the scientific worker can help in the present situation the example of American reaction to the situation as described in the Yearbooks of Agriculture for the last three years is held up for guidance in respect of the development of national resources and the creation of superior life forms, picturesquely called the "Superior Germ Plasm". The experiment stations are to seek means whereby with the same expenditure of time and energy more food may be produced. Reference is made to the hunt for new plants either desirable in themselves or as breeding material for new types, of the 6,000 such new plants got together by Australia, of the expedition to South America to secure new forms of *Solanum* for potato breeding, and of the new clovers and grasses now being evolved. In Great Britain soil conservation has been carefully attended to but the need for a more intensive study of soils *in situ* and in greater depths in accordance with recent methods is emphasised. Balanced nutrition, both of humans and of domestic animals, is to be looked at as closely interdependent so that an improvement of the forage, and health and quality of the latter may lead to a lowering of the cost of animal food to the farmer and to their

* Summary of Address by Sir Thomas Middleton, K.C.I.E., K.B.E., C.B., D.Sc., LL.D., F.R.S., President of Section M—Agriculture—British Association for the Advancement of Science, Dundee, 1939.

consequent improvement in health. The opening of a special station for the study of several obscure stock diseases, committees for the investigation of virus diseases, the preservation of grass and other fodder crops, the addition to the entomological and mycological staffs, and the assistance to fruit research may be mentioned among further efforts on the scientific side.

Finally, the address deals with the role which British agriculture should play in the event of war, and here Sir Thomas would strongly advocate an agricultural policy that would enable the country to produce more food than it now can. The storage of food materials and the ensuring of imports by keeping the seas open, will by themselves not be sufficient and in spite of superior antisubmarine methods in a protracted war the call on the land would be at least as great as it was in the Great War. Much controversy notwithstanding, grass land will have to be broken up and an even more intensive "speed the plough" campaign will have to be carried out, because compared with 1917 and 1918 the arable area has gone down by 3,900,000 acres which is now all under grass. A change in the method of farming is also necessary, *viz.*, a system which under peace conditions would provide about from 35 to 40

per cent. of the requirements and in an emergency would enable us to rapidly increase it to about 50 per cent., that is to say, a system of temporary grass to replace part of the present permanent grass, as is already in vogue in Scotland. The flexibility of the system which makes it suitable both for peace time as well as for war time, is a great advantage in its favour. Many problems would arise in connection with such a change-over from an old established practice of the country and in addition to enlisting the confidence of the farmer much intensive research at a special central research station will be necessary, which will include economic studies and a dissemination of the results of such studies among the younger folk. Sir Thomas is convinced that the change-over will result not only in a larger output of production, but also improve the prospects of farming. The nation, however, will have to pay and as it is for services rendered in connection with defence the farmer's claim will be quite as legitimate as those of others similarly engaged. The address, it must be stated, was written before the war clouds burst over Europe and now that the dreaded situation has actually arisen, the address gains added significance.

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Instruments in Science and Industry*

IN the past, although none too frequently, has the invaluable help rendered by the instrument maker attached either to the laboratory or to a commercial firm, been gratefully acknowledged in many scientific publications. The probable soundness of a theory largely depends upon the accuracy of the data discussed, and among the mathematician's first needs are reliable physical facts. The requirements of the present day are rather exacting and to meet them, all observers now demand far more from their apparatus than was formerly possible, but few realise the amount of thought and labour involved in raising the accuracy obtainable from one per cent. to one tenth of one per cent.

"The development of a particular subject has grown largely with the perfection of the instruments used to investigate it. It is in every way a reciprocal process. By means of an instrument certain evidence is obtained; this evidence does not go far enough, and the instrument must be improved to enable further facts to be found. If, for example, the biologist requires to examine small bodies beyond the range of his microscope, he appeals to the physicist to help him, and the appeal is not in vain. Most probably, as the result of the work on his colleague's problem, the physicist develops a

technique which will be of service either to him or to a fellow-physicist."

Mr. Whippley has chosen for his presidential address, the fascinating, but rather wide theme of the help that instruments have given during the centuries to the development of science. The histories of the microscope, telescope, and spectroscope are recounted in a brief but very interesting manner. Mr. Whippley then deals with the modern auxiliary devices such as the fine dividing engines, temperature measuring instruments, galvanometer and thermionic valve appliances.

"In preparing the design of an instrument it must never be forgotten that a good design helps production. It always pays to spend time in the drawing office rather than in the workshop. The application of geometric design often reduces the cost of manufacture, and makes a better instrument. The experimentalist, in making up his own instrument, should consider whether he can obtain the same result by a simply designed geometric piece of apparatus, rather than the more elaborate design to which he may be attracted.

"The instrument maker constantly receives incentives to progress from the scientific worker to whom he owes not only suggestions, but many of his new materials. If knowledge is to progress, it is essential that theory and practice advance together. Nowhere is this more true than in the development of scientific instruments."

* Summary of the Presidential Address by Dr. Robert I. Whippley, British Association for the Advancement of Science, Dundee, 1939.