

men have dug potatoes in their own garden and tended a pumpkin with their own hand and found no shame in it. The value of practical training in farm work has been well emphasised by Mr. Sampson and I commend his words to the attention of all.

Well, ladies and gentlemen, I see Mr. Hawkins is anxiously waiting to ask me to lay the foundation stone and I will not delay you and him any longer. I would just say in conclusion that it is a great pleasure to meet here the chief officers of the Agricultural Department and to congratulate them personally and very sincerely on the fine work which their department has done in the past. There lies before them, I am confident, a still finer work in the future and I wish them all success in their labours. (Loud applause).

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### **Modern Agricultural Research.**

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In the modern sphere of natural science the most outstanding feature of agricultural research in recent years has been the introduction of physics and mathematics; the former in connexion with chemical and physiological problems, the latter in regard to methods of reasoning, including the statistical examination of approximate results. In other words, there has occurred an extension in the breadth of outlook in agricultural science, greater accuracy, and a breaking down of the arbitrary lines of demarcation which formerly existed between the mathematical sciences and biology. The result is that old problems are now being approached from entirely new points of view, and fresh knowledge is being secured which would never have been gained by means of the approximate and conservative methods that were in vogue for so long. How has this come about? It has come through an evolutionary process that has led to the recognition, especially in the United States of America, that the problems of agriculture are so varied and abstruse that they can only be solved by original work on the part of highly trained men in every department of science. And the modern outlook is even wider; for it is recognised that many problems, in fact most,

can only be solved by collaboration between different experts. The modern tendency indeed indicates that there may come a time when students will be trained to attack a problem rather than to gain a degree, for many of the greatest agricultural problems are most inconsiderate, and do not fit in at all well with the curricula of the Universities and Colleges. But it is not intended to imply that education does or should suffer at the expense of specialization. Education and research are inter-dependent. Nevertheless they work differently, for during education the mind stretches in a horizontal direction, understanding the world in a general way and the true relationship and relative proportions of things; in research the mind dives downwards, guided by original methods and ideas into very profound depths. Both kinds of mental activity are essential, not only for the solution of agricultural problems, but also for general agricultural progress.

Perhaps the biggest advances in recent years have been made in connexion with soil science, physiology and genetics. And incidentally the phrase 'soil science' is an interesting indication of the fact that the arbitrary 'subject' boundaries have dissolved. The study of the soil originally was purely chemical chiefly confined to inorganic analysis. Now the study of the soil involves organic chemistry, physical chemistry, bacteriology, physics, and a number of more specialized studies. The soil is regarded as being organically connected with the plant that grows in it, so that investigators working on soil science are constantly brought into touch with plant ecology, and therefore have to collaborate with the botanist. Agricultural science generally is rapidly assuming a status undreamt of fifty years ago, and is fast taking its place beside Engineering (including all branches). Genetics, or plant and animal breeding, demands for its study a knowledge of mathematics; physiology or the study of function, involves chemistry and physics, and, like genetics, is making tremendous advances. Yet the average man in the street still thinks of agricultural science in terms of entomology, which is as yet the least scientific branch of all.

Then there has also been progress and greater precision on the economic side. Agricultural economic problems are being studied

statistically, and improved systems of account keeping on the 'costing' principle are being suggested and employed. Legislation is being utilized to an enormous extent for the control of pests and diseases, and even their eradication (to wit, the pink bollworm campaign in the United States). Again, measures designed to meet the contingency of 'fluctuations' in the world's market for agricultural produce are receiving attention especially in regard to credit facilities; new and permanent markets are being secured by means of fiscal policies. The great advances in agricultural co-operation in recent years are too well known to need description.

Gratifying as all this advancement is, those who are responsible, especially in respect of natural science, expect their work to be generally appreciated and, as far as possible, applied. In the tropics there is a good deal of apathy as regards research. It takes a long time for new ideas to become firmly fixed in the popular mind. That is because the large majority of those who work the land are not educated along the right lines, and have not developed an enquiring and critical outlook in respect of scientific research. Not that the practical agriculturist will not listen. It is quite astonishing how gullible and easily taken in shrewd business men often are when it comes to the results of scientific research. If they were as careless as to what they swallowed in the form of alimentary food they would die of indigestion or poisoning; if they were as careless in their business they would go bankrupt. Yet, again, others are obstinate and dogmatic, refusing to accept ideas that are sound in place of ones for which they have a kind of superstitious affection.

In the tropics we know far more than we can apply; and it is time that the education of the rising planter be taken seriously in hand. It is necessary that he be educated in such a way that he can follow the trend of agricultural research, so that he can ask himself what are the latest ideas concerning his soil or his particular conditions. He should be as open-minded, progressive, anxious and yet as critical in receiving results, as the research worker is in securing them. What the Americans call extension work would help to bridge the gap at present existing, but extension work costs a great

deal of money, and in any case will not suffice in the tropics. Agriculturists in the tropics suffer from isolation, and, under isolation, education is even more necessary than it is under those conditions of closer contact and enlightenment that prevail in the developing countries of the north. Agricultural education in the tropics is almost a research problem in itself, and its solution is largely bound up in agricultural colleges with collateral work amongst societies, and in the secondary and elementary schools.

(From the Agricultural News.)

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### Reviews.

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*Annual report of the Department of Agriculture, Bombay, for 1920-21.* The report for the year 1920-21 which has just been received, teems as usual with interesting details of the work of the department. There would appear to have been uniform progress in all branches of work. Two important lines of activity deserve special mention and are certainly worthy of emulation. One is a *scheme of fodder storage* to serve as a reserve against years of fodder scarcity. Two different plans were adopted. One was to buy grass when cheap, store in Dutch barns and keep it till it was saleable at a remunerative rate, though it was not to be kept for more than three years. An account of the financial side of the scheme as carried out in Upper Gujarat is promised during the coming year. The second system refers to the storage of shredded "kadbi" in a baled condition. This was started at Kopargaon, Ahmadnagar District after the famine year of 1912, as a result of which large quantities of straw (kadbi) have been made available in recent years of famine. In 1920-21 famine, 3,50,000 lbs. of straw was supplied in Ahmadnagar District.

The control of *famine cattle camps* is the other notable line of activity. Starving cattle are purchased in times of famine and are tended and cared for during the trying periods of scarcity and then resold. At Rahuri camp 1434 animals were purchased at Rs. 20 per head in February. They were sold in June at Rs. 41 each. There was a loss