of university honours schools, while removing the applied scientist to the more bracing climate of a technological institute."

In Lord Eustace's view, the problem of adequately developing the system of technological education in Great Britain can best be solved by carrying out experiments in existing institutions and by making an accurate appreciation of the present assets—the technical colleges and universities. Concerning the technical colleges, he said that he is now convinced (and regretted that this was not said in the report which commonly bears his name) that the necessary development and experiment cannot be hoped for so long as colleges are owned and administered by local education authorities. "A college of technology may be a State institution, like the Scottish central colleges, or it may be an independent institution like an English university college; but it cannot be administered by a municipal committee. And, in fact, the recommendations of the Percy Committee have fallen flat owing to the obstinate reluctance of the Ministry of Education and the local education authorities to do anything so 'undemocratic' as to select one institution from among others for special development, or to allow an independent governing body to spend the money of the ratepayers. So long as this continues, it is hardly too much to say that half our assets for experiment and development in higher technological education are immobilized in a blocked account."

Concerning universities, Lord Eustace claimed that many of the English provincial and the Scottish universities are achieving a natural integration of all the sciences with a bent towards their application, that such integration is the life-blood of all technologists and that existing institutions seeking such an ideal must offer more favourable ground for further experiment than any new institution serving an ill-defined ideal of segregation. Finally, many of the difficulties in the way of better technological education arise from the organization of the national industries and, in particular, from the short academic life of the engineer compared with that of any other industrial scientific worker, a fact mainly due to the apprenticeship requirements of the engineering industry and the membership conditions of some professional institutions.

The discussion on Lord Eustace's address was opened by Lord Cherwell, who felt that the universities cannot cope with the type and extent of development in technical education which is urgently needed. He quoted the technical university of Aix-la-Chapelle, which has numerous professors, full, part-time or extraordinary, giving only two or three lectures a week, and which is run at very high cost. A similar institution in Great Britain would cost about a quarter of a million pounds a year to run, and would therefore be economically feasible only if it catered for two or three thousand students. Such numbers of technological students cannot be envisaged in any existing university institution except the Imperial College of Science and Technology, London. In the past fifty years, Great Britain has lost to the United States and the Continent of Europe the great lead in technology which she had in the nineteenth century, and it is becoming increasingly difficult for British industry to compete in world markets. It is essential to provide much greater numbers of technologists.

Among other speakers, Dr. P. Dunsheath, who did not agree with Lord Cherwell's pessimistic view of

the technological position, pleaded for engineers with a broad education and for facilities for men from industry to go back to college for further courses, supported by grants sufficient to maintain a family adequately.

Replying to the discussion, Lord Eustace Percy referred to the dangers of drawing analogies from the German system. It should be remembered, he said, that the German university has traditionally been almost an arts college, and that the technical university took the place of the science departments of British universities. Also, great caution should be used in drawing conclusions from the numbers of 'professors' in an institution—the significance of the title in different countries differs greatly.

N. CLARKE

MECHANIZING AFRICAN AGRICULTURE*

MR. J. W. Y. HIGGS, lecturer in agricultural machinery in the University of Reading, Mr. R. K. Kerkham, of the Department of Agriculture, Uganda, and Mr. J. R. Raeburn, reader in economics in the London School of Economics, have prepared a report as a result of a survey of African agricultural methods. They conform to their terms of reference in representing the mechanization of African agriculture as a matter for careful study and experiment. They note that data are not yet available on which to base reliable comparisons of mechanized with native systems of agriculture. For this reason the discussion impartially records both obstacles and opportunities, in statements resembling the red and green lights that permit a motorist to make his way through dense traffic.

Among the 'red lights' are the following: It is considered that savanna type of country offers the best prospects for mechanization of farming, but estimates for such an area near railhead in Northern Nigeria indicate that mechanization should be restricted to preparing the land. Even so, it is thought that farm families would not gain much by accepting mechanization, since it would be unwise to expect mechanical cultivation to produce any major increase in yields per acre. It seems that to some tenants the advantages of mechanization would be almost inconsiderable. The substitution of tractors, etc., for native labour is substitution of costly for cheap factors of production. Moreover, mechanization would make production costs less flexible. Mechanical clearing of bush is expensive and very frequently uneconomic: hand labour should clear bush whenever possible. The authors state that in many areas provision of water supplies, clinics, schools and roads should have higher priority than mechanical cultivation.

On the other hand, 'green lights' are as follows: It is noted that over most of the savannas, where possibilities of mechanization are greatest, Africans are caught in a vicious circle of malnutrition and disease, resulting in a low capacity for work. Mechanization must be one of the principal means of raising real incomes and securing better nutrition. A reasonable estimate of the labour required to open

* Colonial Office: Colonial Advisory Council of Agriculture, Animal Health and Forestry. Publication No. 1: Report of a Survey of Problems in the Mechanization of Native Agriculture in Tropical African Colonies. Pp. ix+124+16 plates. (London: H.M. Stationery Office, 1950.) 4s. 6d. net.

land from elephant grass in Buganda is eighty man-days per acre. One can well believe that the easy and quick performance of tasks which have previously required much toil would be regarded with favour in many areas, and, in fact, richer farmers already insist on having the use of tractors. Kerkham states that in Uganda there are large areas of uncultivated good land. It is emphasized that mechanization would facilitate the introduction of other improvements and, in view of this, there is every likelihood that both directly and indirectly mechanization would raise crop yields. Average crop yields, recorded in Appendix 2, are low. There is no reason to suppose that more than the fringe of improvements in production by agronomic methods has yet been touched. It is stated that mechanization will markedly improve opportunities for personal profit and will make possible increasing productivity and value of land. A recommendation is made that much of the increase in land values be retained by the authorities, so that revenue from the developed and richer areas may help development elsewhere.

The authors of the report do well to present these conflicting views, but in so doing they take no share of the responsibility for local decisions to speed up or slow down mechanization. It must be doubted, therefore, whether the following quotation (par. 157) can be read in isolation from the rest of the report, although it does have the appearance of a general recommendation. "The soundest policy might well be firmly to make economic development as rapid as is acceptable to the people and possible of execution, in most areas using all the opportunities offered to strengthen and give responsibilities to the existing Native Authorities and social groups."

The report includes some penetrating remarks on reactions between mechanization and the African way of life. It is wisely said that African farming systems are well worth examination. An elaborate programme of studies is outlined (pars. 287 and 337). Much can be done to secure and give support to native leadership, as is done, for example, in Northern Nigeria, where the opinions and experience of the administration, native authorities, development departments, religious missions and European and African commercial men have been brought together in a Development Committee. Reference is made to training and the presentation of a development scheme: those sequences and balances are best that win the appreciation and confidence of ordinary men and their wives.

Besides tractors and ploughs, other machines and implements are needed in Africa. The report refers to the prodigious expenditure of labour in the women's tasks of grinding flour and carrying water. Water supplies and small grain mills would result in worth-while saving of labour and would be economic at busy seasons, when the time saved would be put to better use.

The authors note that few agricultural officers have had experience in the use of machinery or of mechanized farming, for it has developed in England only during the past ten years. Training courses are suggested; in England a special machinery advisory bureau should be set up to deal with inquiries from the Colonies. The report contains some broad and rather vague recommendations such as "the variations of human population in relation to basic resources . . . require careful and comprehensive study", or "attempts should be made to discover the amount of European supervision that can be regarded

as optimal under different conditions". There seems to be a misapprehension about "share" payments; in the Gezira scheme of the Anglo-Egyptian Sudan it is profits that are shared; the tenants' accounts are debited with the cost of mechanical ploughing.

Since the authors were debarred by lack of evidence from reaching firm conclusions, their report could have been more brief. On the other hand, it must be commended as an interesting and comprehensive review; it will repay careful reading.

H. GREENE

SUGARCANE RESEARCH IN MAURITIUS

MAURITIUS, an island colony of Britain in the Indian Ocean, is still, in spite of the passage of a hundred and forty years, very attractively decorated with cultural trimmings derived from its French ancestry. The population of the island, now approaching the half-million mark, depend for their livelihood and welfare almost exclusively on a single commodity—sugar. A few other products, notably tea and fibre, offer some prospects of development as complementary crops, the former for the high-rainfall zone above the altitude limit for cane, and the latter for the drier regions and mainly for local manufacture of sugar bags. But, because of its suitability to local requirements both climatic and economic, which has been demonstrated by two centuries of experience and of plant introduction, it seems certain that sugar will continue to occupy a position of paramount importance in the Colony's economy.

Excluding the dependencies—small islands scattered about the Indian Ocean—none of which produces sugar, Mauritius is roughly 720 square miles in area and approximates in size to the County of Surrey in Great Britain. Despite its small size the island (a good illustration of the Scots proverb about 'guid gear going into small bulk') is the largest individual cane sugar producer and exporter of all the British Colonial territories, and it is estimated that the 1950 crop may produce more than 430,000 tons of sugar. If this estimate is justified in the bag, it will be the fourth record crop in succession.

The mounting curve of sugar production and the remarkable series of record crops owe a good deal to the local research and cane-breeding work which has been going on for the last twenty years. The importance of research has long been recognized—not least by the Chamber of Agriculture, a very active and progressive organization of producers which has been in existence for the past century—and this recognition found practical expression in the foundation of the Sugarcane Research Station, as a Division of the Department of Agriculture, in December 1929. For lack of other accommodation at the time of its formation, the new research institution was housed in the recently opened College of Agriculture, a 'temporary' arrangement which lasted for twenty years with increasing inconvenience to both.

In spite of housing difficulties, the Station more than justified its existence. Its most urgent initial task was to produce seedling canes to replace the old varieties, for long the mainstay of the sugar industry, which were 'running out'. The chief qualities required in the new canes were high yield capacity, good sugar content and resistance to drought, pests and diseases.