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Telephone Number: Whitehall 8831
Telegrams: Phusis Lesquare London
Advertisements only should be addressed to
T. G. Scott & Son, Ltd., Talbot House, 9 Arundel Street, London, W.C.2
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WORLD POPULATION AND WORLD FOOD SUPPLIES

AMONG the outstanding changes in the world since 1832, when the British Association first held a meeting at Newcastle upon Tyne, has been the great increase in population, its expectation of life and its standard of living. The numbers of human beings in the world is now estimated at 2,300 millions, and they are increasing at the rate of 20 millions a year. What are the prospects of man being able to provide the food necessary to meet such a rise in demand, what are the problems involved, and how is scientific discovery contributing to their solution? These are the subjects dealt with by Sir John Russell in his presidential address to the British Association at Newcastle this year (see p. 379).

The situation is difficult, and is rendered more so by the uneven distribution of the population of the world, the inequalities in the rate of increase, and the fact that some of the most densely crowded areas can only produce a restricted dietary.

There are three chief lines of attack, namely, extension of the food-producing area, more intensive development of the area already under cultivation and prevention of wastage and loss. At present only 7–10 per cent of the land surface of the world is practicable for cultivation, and though much of the remainder is not regarded as 'climatically suited' to crop growth, some of it may be brought into use. Progress has already been made in the improvement of marginal land. In semi-arid regions, areas previously devoted to low-production ranching have been converted into good grazing country as a result of careful classification according to ecological type, the introduction of new strains of grasses and proper systems of management. Suitable legumes, however, still remain to be found before the best results can be obtained; and in view of the importance of grassland both for the improvement of the livestock industry and the prevention of soil erosion, Sir John Russell puts forward a plea for the setting up of a Commonwealth station devoted to the study and production of herbage plants. In other districts, notably Australia, hitherto unproductive soils are being brought into cultivation following the application of trace elements such as zinc, copper and molybdenum, in which they are found deficient. Extension of the area under cultivation is particularly important in hot regions, where such commodities as oil seeds, fibres, tea, coffee and cocoa can alone be produced. Sociological problems complicate the matter in this case, for the introduction of modern efficient methods is bound to conflict with the traditional native agricultural systems. These difficulties are being gradually overcome, and in West Africa the stage has been reached where mechanization can be introduced into the native community farming. In Central and East Africa progress would be accelerated by the development of a good livestock industry, and the outlook is hopeful; for with the discovery that dams for water storage can be made with the aid of a bulldozer, and a

promising remedy for the tsetse fly trouble having been found, two of the chief barriers to cattle-raising have been removed.

Loss of good land from soil erosion is still a serious problem, and affected areas must be brought back into cultivation. Considerable progress has already been made in this direction; but though the methods of control are now understood, their application involves administrative as well as technical difficulties. Remedial measures cannot be carried out piecemeal, and large-scale planning, together with voluntary co-operation of all concerned, is essential for success. The United States soil conservation services have done excellent work in this respect, and provide a model for other countries to follow.

Increased yields can undoubtedly be obtained from the land already under cultivation, and it is along these lines that the outlook for increasing world food supplies is most hopeful. In hot climates much can be achieved by the extension of irrigation, and some schemes have already been worked out. In Asia, the first essential is an increase in rice production, and the crop offers vast scope for development. Thanks to what seemed a discovery of academic interest only, regarding the oxidation-reduction potential of water-logged soils, methods for the nitrogenous manuring of rice have now been put on a scientific basis, and yields can certainly be improved by the wider application of fertilizers. With the additional help of the plant breeder, increased production might well be looked for and a major factor in the cause of unrest among the nations of the East be removed. In the semi-arid regions of India and Africa more attention could profitably be paid to the millets.

Greater efficiency in production could also be achieved in many parts of the world by a modification in the size of holding, the introduction of improved systems of husbandry and the adoption of some form of co-operative scheme. A more generous application of fertilizers, of which fortunately there is potentially no shortage, would also greatly increase output, though at present lack of transport and industrial capacity are factors limiting their use. Mechanization has made rapid advances, and the engineer is enabling the farmer not only to grow and harvest his crops more efficiently, but also to avoid loss on storage. Grass is a most valuable product, yet losses of 30 per cent of protein equivalent may be incurred if it is turned into hay. Artificial drying, on the other hand, preserves the nutrients intact, and greater use could profitably be made of this method if more equipment were available. Increased intensification, however, favours the spread of pests and diseases, and fresh methods for their control have continually to be sought. In the case of some plants resistant varieties can be produced, while the new chlor- and phosphorus-insecticides are proving highly successful against a number of pests. Animal diseases, too, account for heavy loss, and in Great Britain alone seriously reduce the milk yield.

Industrial development is essential in the more backward countries, both to supply the necessary machinery, chemicals, etc., required by modern methods of agriculture and also to provide employment for those no longer required under the more efficient systems of husbandry. Only thus can the standard of living be raised.

New discoveries in pure science continue to be made. Some of them find immediate application in agriculture, while others may for a time appear to be of academic interest only. The discovery of the auxins, during experiments on the response of plants to light, is an example of the latter type. These growth-promoting substances are now used for a variety of practical purposes. They stimulate root cuttings, can induce the production of seedless fruits in tomatoes and cucumbers, prevent potatoes from sprouting during storage, control the pre-harvest fall of apples or act as selective weed-killers. Equally striking results are being obtained with animals. The fat content of milk can be increased by the injection of thyroxin or the oral administration of iodinated protein, while lactation can be induced in virgin heifers or barren cows by means of diethylstilbœstrol. Artificial insemination is spreading rapidly, and even greater developments in its use can be foreseen if the work in hand on transplants of ova from one cow to another can be brought to a successful conclusion.

In spite of all this progress, there are three chief limiting factors, which offer a challenge to agricultural science. The plant upon which food production ultimately depends can only utilize 5 per cent of the radiant energy available, the animal only converts 10–25 per cent of its food into human food, while only 7–10 per cent of the surface of the world is under cultivation.

In conclusion, Sir John Russell stresses the importance of the human factor. However successful we may be in solving the scientific difficulties, moral and spiritual problems lie at the root of our most serious troubles. Science offers us great possessions; but the democracies still have to learn that these possessions imply great personal responsibilities. The difficulties are great; but the outlook is not hopeless. Problems in the past, which have seemed insurmountable, have been overcome, and, given the right spirit, man might yet solve those of the future.

GREAT AMATEUR MATHEMATICIANS

The Mathematics of Great Amateurs

By Prof. Julian Lowell Coolidge. Pp. viii+212. (Oxford: Clarendon Press; London: Oxford University Press, 1949.) 21*s*. net.

WHEN in my younger days I wrote some papers on celestial mechanics, and was thus brought into the circle of the astronomers, I could not help noticing the difference in type between them and the mathematicians, to whose company I properly belonged. There were few professional astronomers, and the great majority of the fellows of the Royal Astronomical Society were amateurs; indeed, many of the most important advances in astronomy—the discovery of Uranus by Herschel, the discovery of spiral nebulæ by Lord Rosse, and the creation of