AGRICULTURE IN THE UNIVERSITY COLLEGE OF THE GOLD COAST

By Prof. JOHN PHILLIPS

THE Cocoa Marketing Board of the Gold Coast, with the approval of the Government, has made available to the University College of the Gold Coast the sum of £1 million for the purpose of establishing and endowing an Agricultural Research Station in the Forest Region. Of this amount, the sum of £750,000 has been allocated for investment for staffing and other recurrent expenditure likely to be associated with the proposed Station, while the sum of £250,000 is to be available over the course of the next four years for purposes of capital development.

At a ceremony at the Agricultural Research Station of the Department of Agriculture of the College, at Nungua, near Accra, a cheque for £750,000 and one for £40,000 as the first contribution toward capital needs were presented by the chairman of the Cocoa Marketing Board to the Principal of the University College on February 28.

Briefly, the objectives of the proposed centre, which is to be established in an area of forest on soils considered to be typical of a large area of the forest region, include : (1) Provision of educational facilities for students of agriculture—undergraduate and senior. (2) The investigation of problems in the management of forest soil, including the possibilities of improving on existing practices in 'shifting cultivation' or 'bush fallowing' and the enhanced production of food and commodity crops both annual and perennial. (Among the commodity crops would be cocoa, coffee, cola, citrus, banana, pineapple—and by some special arrangement relating to site, aspects of oil palm production.) (3) Through studies both at and beyond the centre, the gathering of information relating to the economics of production of selected commodity and other crops, with emphasis on cocoa. (4) Study of problems of production, within the forest region, of poultry, pigs and sheep in certain circumstances. (5) Application of special techniques in the removal of woody growth and the cultivation of forest soil—bearing in mind the dangers of extensive and prolonged exposure of these soils to insolation and heavy and consistent rainfall. (6) The organization of a centre on which professional advisory service of a non-routine nature relating to forest agriculture could be based. (7) Establishment of a centre at which scientific and other research workers concerned in the problems of forest agriculture could work, on invitation, from time to time.

The proposed Station is a logical successor to the first research centre established by the University College in 1952 at Nungua, on the Accra Plains, for students of agriculture and for research into the classification and development of soils ; crop production under irrigation and on rain-fed land ; animal production and pasture management ; aspects of soil and water conservation ; mechanization of agriculture and agricultural management and economy. The progress at this Station has been sufficiently encouraging to attract the interest of the authorities to an extension of the University College's activities to the most important economic region in the country, that of the mixed evergreen forests.

The University College is in special relationship with the University of London in respect of academic standards, examinations and the conferment of degrees. At the present there are eleven men reading agriculture in the first, three in the second and three in the final year of the agricultural course proper. Special scholarships for men reading agriculture at the College are offered by the Cocoa Marketing Board and the Agricultural Development Corporation of the Gold Coast. A wide range of research by members of the staff is in progress.

THE ART OF SCIENCE

PROF. L. C. BEADLE'S inaugural address, "The Art of Science", which he delivered on October 28, 1954, at Makerere University College of East Africa, Kampala, Uganda, on taking up the chair of biology there, and which has now been published*, is a brilliant exposition of the thesis that every educated person should know something of the history of science and of the nature of creative research. No summary can do justice to an address which abounds in humour, in sense and frank avowals of the author's convictions, but which can scarcely be quoted without distorting the balance of his argument. He starts by insisting that the inclusion of a subject in the curriculum of a university cannot be justified solely on grounds of utility and that no one can fully understand the nature of science without some knowledge of its history. He pauses in his survey of the history of science to observe that the medieval conception of science as a finite body of established facts is exactly what science is not, and to comment that so far there has been a sufficient number of practising scientists in the teaching profession to frustrate the attempts made during the present century to revive the conception through the invention of examinations. Turning to the biological sciences, he points out that the main creative act in biological research is the decision as to what the problem is, and then the posing of the right questions ; he does not believe that the biologists can entirely avoid considering the problem of mind and body. If, however, the great progress now being made, with the aid of new techniques, in the physiology of brain and nervous system, on one hand, and in the study of animal behaviour, on the other, leads to the two streams meeting at any point, there should be results of great practical value, and the combined streams might be deep enough for the psychologists and philosophers to navigate.

In dealing finally with the question, "What is the art of science ?", Prof. Beadle remarks that the first and greatest exponents of the scientific method,

* The Art of Science : an Inaugural Address delivered at Makerere University College of East Africa, Kampala, Uganda, on October 28th, 1954. By Prof. L. C. Beadle. Pp. iii+32. (London : Oxford University Press, 1955.) 3s. 6d. net.

Bacon and Descartes, though themselves creative thinkers, apparently misunderstood the true nature of creative work. Both seem to have missed the point that scientific discovery is primarily a matter of intuition, that is to say, it is an art. The most essential feature of a creative scientific thinker, Prof. Beadle insists, is his power of imagination and intuition; and knowledge and experience, such as can be got from formal education, are the background from which spring those imaginative flights which are the essence of scientific discovery. He suggests that the greatest single need for the scientific development of Uganda is that the young children should be encouraged, more than they are, to play and experiment. It is the task of the schools to preserve the experimental and imaginative outlook and to protect it against the pernicious influence of examination syllabuses; and it is the task of the universities, the demands of which determine so much the teaching syllabuses in schools, to frame their demands so as to encourage the schools to teach real science, and also to send them teachers who really understand what science is.

EFFECT AT GROUND-LEVEL OF GAS FROM A CHIMNEY-STACK

THE determination of the maximum concentration at ground-level of gas emitted from an industrial chimney-stack is an important problem in the application of meteorology to health. Sutton[1] showed that the concentration at ground-level downwind from the chimney of gas at the same temperature as the surrounding air drifting out of the top rises to a maximum with distance from the chimney and then falls off. He gave a formula for the maximum concentration in terms of wind speed, height of chimney, the atmospheric turbulence coefficients and the atmospheric stability. Usually, the gas is hotter than the surrounding air and has an appreciable vertical speed at the top of the chimney. Both factors cause the gas plume to have a vertical component of speed for some distance from the chimney. The centre line of the plume gradually bends over to become horizontal along the wind at a great distance from the stack.

Recently, Dr. A. C. Best[2] has examined, with the view of helping the stack designer, the relative merits of the following three formulæ for finding the maximum concentration at ground-level of gas from a heated elevated source: (*a*) an extension of Sutton's 'cold' gas formula; (*b*) a theoretical one due to Bosanquet, Carey and Halton[3]; and (*c*) an empirical one suggested in the United States at the Atomic Energy Station, Oak Ridge[4]. Sutton's 'cold' gas formula is applied to the 'hot' gas problem by replacing the chimney by one at a height greater by a length proportional to u^{-3}, where u is the wind speed. Dr. Best shows that the other two formulæ are equivalent to treating the problem in the same way but with additional heights, for (*b*) proportional to u^{-2} (approximately) and for (*c*) to u^{-1}. He calculates the maximum values of concentration of gas at ground-level for various realistic values of wind speed, height and diameter of chimney, and rate of heat output by the chimney relative to the surrounding air, for example, speed of efflux 5 and 15 m./sec., diameter 5 and 10 m., heights 50, 100 and 200 m., and heat output 10^5–10^8 cal./sec.

Formulæ (*a*) and (*b*) give values with ratios mostly nearly unity and with a maximum of 1·66, and formulæ (*b*) and (*c*) give ratios twenty-five of which were less than 2, thirty-eight less than 3, and with the greatest ratios 4·3, 5·6 and 6·4 occurring only for the somewhat abnormally great stack height of 200 m. The results apply only to occasions of a small fall of temperature with height. An inversion above the chimney would make the concentration at ground-level markedly greater. Formula (*c*), which is

$$\text{maximum concentration (mgm./m.}^3) = \frac{9 \times 10^6\, Q}{h(14\, vd + H)},$$

where Q is strength of source in lb./sec., h height of stack (ft.), v speed of efflux (ft./sec.), d diameter of stack (ft.), and H rate of heat output relative to the surrounding air (B.Th.U.), gave the greatest values for the worst conditions of low height, small speed of efflux and low heat output. For this reason, and also because it is the simplest to use, Dr. Best suggests the Oak Ridge formula is the most suitable one for the stack designer.

[1] Sutton, O. G., "Micrometeorology", p. 292 (London, New York and Toronto: McGraw-Hill, 1953).
[2] Best, A. C., *Met. Mag.*, **84**, 297 (1955).
[3] Bosanquet, C. H., Carey, W. F., and Halton, E. M., *Proc. Inst. Mech. Eng.*, **162**, 355 (1950).
[4] Rep. U.S. Atomic Energy Comm., Oak Ridge, Tenn., No. *ORO*-99 (1953); formula also quoted in Rep. Comm. on Air Pollution (Cmd. 9322), (London: H.M.S.O., 1954).

NEW NATURE RESERVES IN ENGLAND

THE Nature Conservancy has recently established two new nature reserves—Fyfield Down, Wiltshire, and Westleton Heath, Suffolk—and in addition has acquired further land for the existing nature reserve of Yarner Wood, Devon.

Fyfield Down is one of the finest remaining tracts of unreclaimed high chalk downland in England and is probably the richest in sarsen stones, locally known as 'grey wethers', from their resemblance when seen in the distance to a flock of sheep. It is probable that the great 20-ft. sarsen stones in the circle at Avebury (weighing about 60–70 tons) were brought there from Fyfield Down nearly four thousand years ago to form the oldest important structure in Britain and one unique in Europe. Being close to Avebury, the new reserve is within one of the principal areas inhabited by prehistoric man, and the Celtic field system is one of the largest in England. There is a tumulus to the south of the fields and two others along the western boundary formed by the Ridge Way, which at this point crosses another ancient track known as the Herepath. There are also remains of an ancient village along the 700 ft. contour, the highest point on the reserve being about 830 ft. The sarsens are large blocks of sandstone apparently derived from a bed of sand which covered the site in Eocene times. Their distribution is considered to be natural, none having been erected as standing stones. They produce an effect of great botanical interest, being accompanied by pockets of acid soils, on which grow acid-loving plants such as sheep's sorrel. This is in contrast to the ordinary lime-loving plants of downland; meadow saxifrage (*Saxifraga granulata*)