LEGUMES IN AFRICAN AGRICULTURE

A TECHNICAL meeting on "Legumes in Agriculture and Human Nutrition" was held recently at Bukavu, Belgian Congo, under the joint auspices of the Food and Agriculture Organization of the United Nations and the Commission for Technical Co-operation in Africa South of the Sahara. Delegates attended from the Belgian Congo, French territories in Africa south of the Sahara, Nigeria, Federation of Rhodesia and Nyasaland, Northern Rhodesia, Southern Rhodesia and Portuguese territories in Africa.

The Agricultural Section at this meeting, under the chairmanship of Mr. A. Angladette, of the Office de la Recherche Scientifique et Technique Outre-Mer, had a very full agenda since attention had to be given to the cultivation of legumes for human food (grain or green vegetable), grazing and fodder production, as well as the improvement of soil fertility through the cultivation of these crops in rotations or as green manures.

Statistics with regard to acreages and production of grain legumes are entirely inadequate; but a general trend may be seen towards increased cultivation of cash crops and the progressive elimination of grain legumes, with the exception of the groundnut where it is grown commercially for export or for oil extraction. Grain legumes may be grown in the garden plot close to the house, in association with other crops and on soils rich in organic matter, or in the 'outfield' in the cropping phase of shifting cultivation.

The most widespread leguminous grain crops at the present time are groundnuts and cowpeas (*Vigna sinensis*), with the haricot bean (*Phaseolus vulgaris*) at the higher altitudes. Interest in *Voandzeia* and the acreage of this plant are decreasing. The greatest need for grain legumes is, however, in the low-lying wet tropics where there are no livestock or grain crops, and the people live on starchy foods such as cassava.

The delegates to the Nutrition and Agricultural Sections of the meeting recognized that some twenty African grain legumes could be regarded as of primary importance from both a nutritional and an agricultural point of view, and that these therefore represented a good basis for future development. The meeting, and particularly the delegates from the Belgian Congo, nevertheless stressed the need for a thorough search in local floras for new legumes for use as food, fodder, shade and cover plants and green manure crops. Any new material which might be found should be the object of study by the plant breeders, who should concern themselves with both quantity and quality (higher protein content and acceptable palatability). Attention should also be given to the production of varieties adapted to methods of cultivation and harvesting involving draught animals or powered machinery.

It would be desirable to facilitate the interchange of seeds of present or new types of plants between the different parts of the region. Seed samples should always be accompanied by adequate data regarding the ecological conditions of the station of origin or place of collection, and also, if possible, by a herbarium specimen for checking purposes. The need to establish herbaria for species and cultivars was also stressed.

The extent of cultivation of legumes for grazing or cut fodder varies considerably as between the different territories. Considerable success was reported in the sod-seeding of *Stylosanthes gracilis* in the existing pastures in the savannah zone. The pigeon pea (*Cajanus cajan*) is grown as spaced hedges in pure Rhodes grass (*Chloris gayana*) pastures in Southern Rhodesia. *Centrosema pubescens* and *Pueraria javanica* are promising for the wetter areas, with *Stizolobium deeringianum* as cut fodder. An important factor limiting the greater use of grazing and fodder legumes is the lack of adequate seed supplies. The meeting, therefore, stressed the need for promoting greater production and better distribution of seeds of legumes adapted to the various regions, supported by a service designed to control quality. Research on seed biology (hard seeds, viability, etc.) is also necessary.

It was agreed that the foremost problem is at present to grow better the legumes already available. There are wide differences between the yields obtained by the average cultivator and those which may be obtained with improved methods of cultivation. Correct and adequate mineral nutrition and an optimal legume/*Rhizobium* relationship are among the primary factors to be considered in this connexion. The policy of fitting the soil to the legume is much more difficult in African peasant agriculture than under more intensive systems of farming. It is also desirable to fit the legume to the soil by the selection, for example, of varieties adapted to either high or low levels of soil fertility. Economic considerations are important in this respect.

On these aspects the meeting recommended that more attention should be paid to fundamental research on legume nutrition and on the factors affecting the development of their associated *Rhizobia*. Workers in Africa south of the Sahara have requested the United Nations Food and Agriculture Organization to publish and keep up to date a world list of scientific institutes pursuing studies on *Rhizobia*, as well as a catalogue of the strains that these institutes have available.

Many examples were quoted of the serious economic losses caused by fungous diseases and insect pests both in the field and in the store. In the latter connexion, it is desirable to evolve cheap methods of grain storage for peasant farmers; for example, oil drums with screw tops into which beans could be placed when quite dry, and in which any beetles or other insects would be smothered. It is desirable that countries should publish a list of the pests and diseases of legumes and evaluate the economic importance of the losses they cause, carry out studies of the biology of the most important ones, develop methods for their prevention and control, and prevent the introduction of pests and diseases from other countries or territories by observing international phytosanitary regulations.

It is obvious that legumes can contribute greatly to the improvement of human and animal nutrition

and to the fertility of the soil in Africa south of the Sahara, as in other parts of the world. Many questions, however, remain unanswered, and the need now is for a well co-ordinated programme of research, dealing with as many aspects as possible but avoiding duplication of effort. The delegates to this meeting repeatedly stressed the need for governments to provide more funds and facilities for this research. They also indicated to the organizations sponsoring this meeting that regional conferences or special study groups could with advantage give attention in due course to the correct utilization and development of the grazing and fodder resources of Africa south of the Sahara, and also to the specific problems of mineral nutrition in relation to legume *Rhizobia*, and the incidence, biology and control of pests and diseases of African legumes.

A report of this meeting will be available shortly in English, French and Spanish.

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GELATINE AND GLUE RESEARCH

THE sixteenth meeting of the Research Panel of the British Gelatine and Glue Research Association was held on December 12, with Mr. S. G. Hudson (Richard Hodgson and Sons, Ltd.) in the chair. Three papers were presented, each by members of the staff of the Association, and were discussed by an audience representative of both the industrial and academic aspects of the work.

The first paper, on "Solubilized Collagen", by Dr. A. Courts and Dr. G. Stainsby, was presented by Dr. Courts, who mentioned briefly the preparation of soluble collagen, especially from the skin and other collagenous tissues of young animals. He then described the modification of the corresponding tissues of adult animals, by cold alkaline pretreatment, to enable the usual solvents for soluble collagen (citric acid and citrate buffers) to extract substantial fractions of the pretreated collagen in the cold. The solutions obtained showed qualitatively similar behaviour to soluble collagen, such as high viscosity in very dilute solution, precipitation in fibrous form on dialysis against distilled water, or on the addition of salt, and conversion to gelatin on warming. Quantitatively, the intrinsic viscosity, while varying to some extent according to raw material and mode of pretreatment, was in agreement with the results of Doty and Nishihara[1] for soluble collagen from calf-skin. Ossein, the demineralized organic component of bone, gave, in a typical experiment, a 30 per cent conversion to solubilized collagen, and there was no reason to regard this as the ultimate limit possible. Sinew and skin were more difficult to convert, but the same general behaviour was observed. The pretreatment processes, if not in detail reversing the process by which collagen is laid down in insoluble form, leave fragments which may have structural significance for the original tissue. The temperature of conversion from the solubilized collagen to gelatin in citrate buffer at *p*H 3·7 was in the region of 30° C., which is lower than that reported for soluble collagen from calf-skin. There is probably only a slight difference in temperature of conversion at neutral *p*H values. The change in optical rotation was measured by Dr. A. Todd, and gave values of specific rotation $[\alpha]_D$ for the soluble collagen and derived gelatin close to those of Doty and Nishihara[1], although confirming the lower conversion temperature of 30° C. noted above.

Mr. A. A. Leach read the second paper, on "The Examination of Gelatine by Passage through Amberlite Resins of the 'I.R.C. 50' (Carboxylic) Type". The paper consisted of a critical examination of the separation of gelatin into two components, by *XE*.97 resin, reported by Mr. G. Russell (Ilford, Ltd.) at the fourteenth meeting of the Research Panel and in a short account in *Nature*[2]. In a typical experiment, a small quantity of gelatine was placed at the top of a resin column previously equilibrated to the required *p*H. Buffer solution at the same *p*H was then passed through the column, fractions collected, and the concentration of protein estimated by the Lowry method, or collected for further analysis. To obtain sufficient of any minor components, large columns of resin were used. It was shown that from *p*H 3 to 5·25 a very small proportion (about 0·3 per cent) of the gelatine used (laboratory sample 127) passed through the column with negligible adsorption, while the remainder was firmly adsorbed as long as the column was not overloaded. Amino-acid analysis of the small eluted fraction gave only a very low content of hydroxyproline, little glycine or proline, and high valine, leucine, *iso*leucine, tyrosine, threonine and aspartic acid compared with the whole gelatine. The analysis is similar to that of Maron[3] for an impurity isolated by adsorption on charcoal.

At higher *p*H, increasing amounts of gelatine 127 are separated in the first peak, while retaining a sharp separation from the remaining adsorbed gelatine. By *p*H 6, 93 per cent of the gelatine was eluted. The percentage eluted could also be increased by overloading a column. Chemical analysis showed that, as soon as several per cent of the gelatine is contained in the first peak, either by overloading or by raising the *p*H, the bulk of the eluted fraction is a substance of gelatin type containing hydroxyproline, with a composition almost identical with the parent gelatin. There was evidence that molecular weight played some part in the separation and a possibility that minor differences in amino-acid composition were also present. No evidence was found suggesting the presence of the 10–20 per cent of a non-gelatin-like component reported by Russell.

The differences between resin batches were shown to be, in the main, accountable in terms of surface area. Two further gelatines (laboratory samples No. 142, *p*I 7·8 and No. 149, *p*I 9·4) of acid-process type showed similar behaviour to gelatin 127 (*p*I 4·95) but the corresponding percentages eluted were found at higher *p*H.

The third paper, "Some Factors influencing the Melting of Gelatin Gels", read by Dr. G. Stainsby, was based on his work with Mr. J. T. Taylor. After reviewing the arbitrary character of melting-point measurement, Dr. Stainsby described the Association's method, which uses as indicator the flow of a drop of carbon tetrachloride down the thin molten layer in contact with the wall of the thin-walled test-tube in which the gel has been set and matured.