GENERAL INTRODUCTION

It is well known that livestock enterprises in the tropics are not as productive as they are under temperate conditions. This may be ascribed to two main factors:

(a) The inherent characteristics of the breeds and

(b) the environment.

The two are interrelated since the breeds have evolved for adaptation to the tropical environment. It would appear that this adaptation is physiologically irreconcilable with a high level of production. Of the environmental factors, climate, nutrition and management are most important. Various methods have been employed to secure higher production: these have taken the forms of introducing temperate breeds, selecting and improving indigenous breeds, crossing exotic with indigenous breeds and amelioration of the environment.

The improvement of nutrition is very important. Nutrition is considered by some to be the most important limiting factor to production and Shaw and Colville (1950) in their report on livestock improvement in Nigeria stated that "The basic problem concerning any livestock improvement in Nigeria is not one, in the first instance, for the geneticist but for the animal feeder. It is the nutrition of the existing breeds of cattle, sheep and goats that has first to be put on a higher plane before the geneticist and animal breeder can either select or improve". The poor quality of nutrition has been recognised since the 1920s and Hammond (1931) imputed the low productivity of cattle in the West Indies to poor nutrition.

Nutritional studies in the tropics have been going on for the past thirty years. Local feeding stuffs have been investigated at this institution, in East Africa, India and other tropical and sub-tropical regions.

In most cases studies have been limited to the composition of feeding stuffs and few digestibility studies have been carried out. Digestibility trials have been made with stalled cattle and with sheep and goats in crates. The harnessed faecal collection bag has also been used.

The choice of animals for nutritional studies is very important. Animals should be in good condition and must be as homogenous as possible. In particular they should be of the same age and weight. Where this is not possible and many treatments are under test, age and weight can be confounded with treatments. It is not recommended to use pregnant or milking animals or young ones in digestibility trials since they tend to confuse results. Generally castrate male adults are used.

Where the results of a trial are to be analysed statistically, the number of animals used should be such as to give an error large enough for comparison. Forbes, Elliot, Swift, James & Smith (1946) have suggested that for experiments with sheep five animals per treatment are sufficient if the experimental technique is efficient and animals are treated for parasites.

In digestibility studies the food intake of the animal is important. High intake of dry matter may reduce digestibility or vice versa. On the other hand, consumption that is markedly less than appetite may affect the usefulness of the results obtained for comparative studies. Food consumption in sheep is extremely variable. Woodman, Evans & Eden (1937) have given dry matter intake under temperate conditions to vary from 1155 gms. to 1654 gms. per day. Pickering (1954) has given consumption of fresh Guatemala grass by sheep to vary from 2064 gms. to 3660 gms. per day which assuming a dry matter content of 20% is between 400 gms. and 700 gms. Smuts and Marais (1940) in South Africa and Worth and Krishnan (1935) in India have also reported consumptions lower than those for temperate sheep of the same weight. Similar observations have been made on cattle; Harrison (1942). It has been suggested that this lower dry matter intake may be due to high moisture content of grass.

The acclimatisation period in feeding trials ensures that the end point error due to previous feeding history is eliminated. Faecal output should be related to the ration fed during the trial period. Raymond, Harris & Harper (1953) have stated that digestion coefficients after a few days feeding show wide fluctuations but become steady after eight days and

have recommended a preliminary period of seven to eight days. Castle (1956) working with stained particles observed that these appeared in sheep faeces between eleven and fifteen hours after feeding, reached a maximum in thirty hours and disappeared after six to seven days. Blaxter, Graham & Wainman (1956) have suggested feeding the experimental ration at regular intervals for a long period to ensure that a steady state of faecal excretion is reached and then to collect data for a specified period. It appears that eight days is the minimum for a preliminary period in digestibility studies.

Digestibility coefficients are calculated on the basis of the difference between input and faecal output of dry matter and its constituents. But this is not accurate since no account is taken of the losses that take place during digestion or additions to the faeces from metabolic origin. Thus the loss of carbohydrates in the form of methane is not reckoned with. Also, it has been shown by McDonald (1948 a & b); Cuthbertson and Chalmers (1950); Annison, Chalmers, Marshal and Synge (1955) that loss of nitrogen takes place in ruminant digestion due to protein deamination by bacteria. Ammonia released by deamination is utilised to synthesise bacterial protein which is eventually digested by the animal. But if rate of deamination exceeds rate of synthesis ammonia is absorbed into the blood stream, converted into urea and excreted in urine. Hence a proportion of what is regarded as digested crude protein is ammonia which is lost. For this reason it is advisable to determine the nitrogen balance in all digestibility studies so as to ascertain the utilisation of the protein by the animal. On the whole, digestion coefficients as calculated are just "apparent" in view of these losses and metabolic additions to the faeces.

Live weight changes, although important guides to the value of a feeding stuff, are not very reliable in assessing the nutritive value since it is impracticable to analyse the composition of a gain or loss in weight. An animal may gain in weight by putting on more flesh, or more fat deposition or through retaining a larger amount of material in its alimentary tract at the time of weighing than at the previous one. In the same way weight loss may be due to use of body tissue or when weighing is done at a time when alimentary tract content is lower than at first weighing.

It is against the above background that the three following experiments

have been conducted, using sheep. Experiment I investigates the digestibility of a soilage grass, elephant grass, under two different conditions within crates; Experiment II is concerned with the digestibility and nutritive value of a pasture grass, pangola grass; and Experiment III investigates the digestibility of an arable by-product, sugar cane tops. Six Persian black face wethers were used in each experiment. A serious handicap was the paucity of animals suitable for experimental purposes. Only seven wethers were above 65 lbs. liveweight; the rest were much lighter. The use of ewes was considered but it was learned that many might be in lamb. It was therefore decided to leave them out of the experiments. Also dates of birth and birthweights were unavailable. The heterogenity of the animals and the inadequate replication might have profound effect on the analysis of the results.

All experiments were conducted in the Nutrition Barn on the College Old Farm.