

## INTRODUCTION.

The improvement of livestock under tropical conditions, as in temperate regions, revolves around improvements in management, including feeding, and breeding, although the tremendous differences in environmental conditions necessitate a revision in the application of the principles involved. The stage reached in the improvement of livestock in the temperate regions is far in advance of that in the tropics due to economic and social factors, but it is from experience gained with cattle in the temperate regions that we must approach the problem of improving livestock in the tropics.

Yet here lies considerable danger. Direct application of knowledge gained under temperate conditions often yields extremely disappointing results, because the conditions of climate and vegetation and the state of knowledge, customs, and the facilities at the disposal of the people are either not known sufficiently or are ignored.

The writer is concerned mainly with the problems underlying improvements of dairy cattle by breeding, but it is essential to appreciate that improvement can only be attained and maintained by breeding as long as conditions of economic management possible for the commercial producer, often the peasant farmer, will allow the better bred stock to develop their potentialities sufficiently to be an improvement on their ancestors. Temperate dairy stock give much higher yields of milk under conditions most suited to them than do tropical cattle in their own environment. It is not surprising, therefore, that the first attempts to improve dairy stock in the tropics were by the introduction of temperate high yielders, notably Friesian and Channel Island cattle.

Improvement of milk yields by the introduction of temperate breeds of dairy stock (*Bos Taurus*) has been attempted and to a degree

attained by two principal methods, establishment of the pure Bos Taurus, and cross-breeding of Bos Taurus with the Zebu (Bos Indicus). But repeatedly the sequel has been only a very temporary increase in productivity, followed by a gradual deterioration in the imported stock and their cross-bred progeny. Exceptions to this rule may be found in certain dairy herds in the tropics. Pure bred European stock have been kept successfully, maintaining high yields, but under artificial conditions of feeding and general management incapable of adoption commercially. One of the principal problems of the animal breeder in the tropics is to produce, and to continue to produce, a cow suitable for the peasant farmer with his odd acre of land, strictly limited finances, and very poor grazing. No temperate breed will stand up to the rigours of a tropical climate under such a system of management. Another exception to the rule may be found in more elevated areas, such as the highlands of Kenya where the climate and conditions of management are comparable in fact to those in temperate countries.

The failure of cross-bred cattle to maintain the higher production of the temperate animal and the increased heat tolerance of the tropical beast, which is obtained in the first cross, is due to the segregation of genetic factors influencing these characters as a result of proceeding beyond the F.1 generation. It is occasionally possible to obtain an animal from such a cross which will breed true, without such segregation, but the chances are so rare that it is taking unnecessary risks to adopt extensive programmes of cross-breeding for commercial production in the hope of establishing a successful breed type from the combination. But extensive programmes of cross-breeding with little controlled attempts at permanent improvement have been developed throughout the tropics. Considerable lack of foresight seems to have been shown.

Had immediate but temporary improvement by production of half-bred stock, maintained by a pure bred Bos Indicus herd, been adopted together with pilot breeding trials in an attempt to create

a composite breed, and widespread attempts to grade pure bred Bos Indicus stock up to higher milk yields, it is possible that more improvement would have been evident than is to-day after nearly a half century of attempts.

The present-day tendency is to attempt improvement by the introduction of proved Zebu stock, notably of Red Sindhi or Sahiwal blood from India. As has been stated in the case of introduction of temperate breeds into the tropics, it is essential to study the change in environment and its effect on the animal before large scale importations are made. Both breeds can withstand high temperature, but before large scale introduction into a new area, the stock must be studied to determine whether they are suited to the humidity and other climatic factors, fodder resources and systems of management which prevail in that area.

Temperature and humidity are not the only climatic factors influencing heat tolerance of cattle, but work to date suggests that they are the most decisive factors influencing physiological processes involved in heat tolerance. In connection with this problem, Bisschop (1947) has pointed out that although many workers have been able to relate a single meteorological factor such as temperature to one or more animal functions concerned with heat tolerance, this is not really correlating 'climate' with function. Bisschop believes that the only sure way to study the tolerance of cattle to meteorological factors is by making fundamental studies in psychometric rooms where one factor can be varied whilst others are kept at any one of a series of levels. This is undoubtedly true, but as was pointed out at the F.A.O. meeting on Livestock Breeding in the Tropics held in Lucknow in February, 1950, (F.A.O. Dev. paper No.6. Agriculture) breeding and management programmes will not stand still while complex experimental studies are being conducted. Until a climatological distribution of types and breeds has been studied sufficiently to trace out a new breeding programme based on the selection and close-breeding of the better animals in

areas of similar climate, the many breeding programmes at present adopted must continue to be studied with a view to further improvement. It is with this in mind that the writer conducts this experiment.

Rightly or wrongly, the policy in Trinidad is to improve the local (not indigenous) Zebu stock by grading up with imported Friesian cattle, concentrating by the use of grade bulls on the maintenance of Government herds and peasants' cows at  $\frac{3}{4}$  or  $\frac{1}{2}$  bred grade Friesians. It must be borne in mind that these grades become purely theoretical after the first generation and in practice it is likely that in sufficient numbers there is a normal distribution around the theoretical grade with the mean on the grade and a small variation. Because of this it is desirable in an experiment to have a large number of cows randomly picked for each theoretical grade. It is regretted that owing to restricted facilities, there are only two cows under observation in each grade.

The experiment is designed to give some measure of climate tolerance of a grade range of cross-bred Friesians, with the purpose of throwing some light on the grade on which to concentrate and to give some indications as to what course field investigations of heat tolerance should follow.

Climate tolerance is a measure of an animal's ability to maintain a normal body temperature under prevailing climatic conditions. It depends on the animal's ability to dissipate heat as quickly as it produces it and is therefore also a function of time.

Tolerance to heat in cattle is governed by heat production of the animal as a consequence of metabolism, heat dissipation by the thermoregulatory mechanisms of the animal, and climatic conditions. These three factors are closely inter-related. Normal body temperature is maintained by the dissipation of heat as it is produced in the body. Climate influences both heat production and the efficiency of heat dissipation. For a fuller treatise of heat tolerance the reader may refer to Brody (1945), Duckworth & Rattrey (1946), Findlay (1950), but a brief discussion of the factors involved will be of help in understanding the order of the experiment.