INTRODUCTION

Animals differ widely in their ability to thrive and to perform efficiently under a given set of conditions. Some animals are adapted to cold climates, others to temperate climates, still others are more suited to tropical conditions. Certain types of animals, such as the yak and vicuna, thrive at high altitudes, while others cannot survive satisfactorily there. Animals vary also in their grazing ability. Some can obtain a satisfactorily living while grazing over extensive range lands, while others require lush pastures and supplementary feeding if they are to perform efficiently.

Animals vary also in their adaptability to conditions within a given climatic zone. In the temperate zone, for example, some are able to utilize areas of sparse grazing and are thus able to harvest extensive areas of land that would otherwise be of little use to man. They can thus turn forage into products that are of great importance. Such animals are often limited in their productive capacities when placed under excellent environmental conditions. They are able to live and reproduce quite satisfactorily, but they have been developed under conditions where natural selection eliminated the weaklings, and where there was relatively little opportunity for expression of, and selection for, superior milk, meat, or fiber production. Thus, under good environmental conditions, it is necessary to select stock that has the inherent capacity to utilize efficiently large amounts of good-quality feed, if that feed is to be transformed most effectively into products for human consumption.

A few examples will illustrate some of the differences. The Holstein-Friesian breed of cattle was developed in the temperate zone and under conditions of intensive farming. It is well adapted to areas where pastures are good, where it is possible to grow ample supplemental feed, and where there is a market for a sizeable volume of milk. But it is not suited to many areas in the tropics or to areas of scanty feed in the temperate zones. By contrast, the yak is admirably suited to high elevations and extensive grazing conditions such as are found on the Tibetan highlands of Central Asia, but it does not produce at a sufficiently high level to use large amounts of good-quality feed efficiently. Still another contrasting type may be found in the water buffalo. This animal is adapted to tropical conditions; and some breeds, such as the Murrah of India, produce reasonably good quantities of milk while being fed coarse roughage and limited amounts of other feed under tropical climatic conditions that adversely affect Holstein cattle.

Neither the yak nor the water buffalo would be suited to areas where intensive dairying is practiced, such as the Netherlands, or Wisconsin and New York states in the United States of America, for they are not adapted

to the climatic and other conditions prevailing there, and do not have sufficient inherent milk-producing capacity to utilize the available feed efficiently. On the other hand, the Holstein-Friesian, and other highly specialized dairy breeds developed under similar conditions, cannot perform satisfactorily and often are unable to survive under conditions where the yak and the water buffalo can thrive.

The variations in adaptability among highly specialized dairy cattle, yaks, and water buffaloes are quite extreme. Similar examples of extreme variations may be found in other classes of livestock. The Rambouillet sheep is able to find a livelihood on the extensive range lands of the western United States of America, and its close relative, the Merino, makes effective use of the extensive grazing areas of Australia, where grazing is also sparse, and where severe droughts often occur. On the other hand, the Hampshire, Shropshire, and other mutton breeds are better suited to the pastures of the Corn Belt in the United States and to the Down regions of southern England. Still other types, such as the Welsh Mountain and the Blackfaced Highland, are suited to the rugged environment of the highlands of Wales and Scotland, where the climate is cold and damp, and where grazing is generally sparse. But there are less apparent variations, even among types and breeds that have been developed under rather similar conditions, that may be of considerable importance in determining the success with which animals of a given type may be used under a certain set of conditions. It has been demonstrated, for example, that Jersey cattle have greater heat tolerance than Holstein-Friesian cattle and are therefore less affected by the subtropical conditions that prevail in the Gulf Coast region of the United States during the summer months (Seath and Miller, 1947).

Variations in adaptability are important in selecting stock for a given set of conditions. This point has been frequently overlooked in attempts to improve the quality or productivity of stock in a given area. This has been particularly true in underdeveloped countries or regions, where rigorous environmental conditions prevail, and as a result much time, effort, and money have been expended, often with very disappointing results. Similar failures have been observed in well-developed countries, in sections where the climate is rigorous or where feed is scarce.

Relatively little attention has been given in animal breeding to variations in adaptability. The reason is, partially, in the way higher education and experimentation in animal husbandry have developed. Animal husbandry and other branches of agriculture have naturally grown most rapidly in countries having optimum or near-optimum conditions for agricultural production. Such countries have been in the best position, financially, to promote agricultural

research and teaching, and their outstanding institutions have generally developed in regions adapted to intensive agriculture. It has naturally followed that the majority of leaders in animal husbandry have devoted their attention to areas where adaptability to rigorous conditions is of minor importance. And these leaders have taught most of the students from underdeveloped countries, which are without adequate institutions of their own. These students have rarely had their attention called to the problems of adaptability that must be dealt with in their own countries; in few cases have they been given any real appreciation of how to deal with these problems. It is not surprising, then, to find many cases in which these students, returning to their own countries as leaders, have attempted to import stock that was near ideal in the area where they received their training, but which was ill-suited or entirely unadapted to the conditions to which it was taken.

Livestock play an important part in agricultural production in most parts of the world. They supply much of the draft power on farms, and transform rough feed into manure that is essential for maintenance of soil fertility. They also supply milk, meat, skin, and fibers, without which man could not be adequately fed and clothed. Human welfare demands that livestock function with maximum efficiency. To accomplish this, the adaptability of animals to the environment under which they live and produce must be given careful consideration in all attempts to expand and improve livestock production.

This volume has been prepared to call attention to the importance of this problem of adaptability. It summarizes important work that has been done in various parts of the world to determine the reactions of animals to their environment and to develop animals adapted to specific conditions. The inherent or genetic adaptability of animals to various environments is stressed. Obviously, the productivity of animals can also be improved by providing a better environment, for the performance of any animal is determined partially by its hereditary make-up and partially by the conditions under which it is developed and maintained. But, in many areas, limitations are laid down by nature. The livestock producer may progress only to a certain point in improving, within economic limits, the supply of feed and other environmental factors. In tropical and subtropical areas, many of the conditions under which cattle must be produced are determined by nature. If a producer's cattle are to perform profitably, he must select and breed animals that are adapted to the environment. This is equally true of vast semiarid regions, high mountain and plateau regions, subarctic areas, wet hill country such as the highlands of Scotland and Wales, and other areas where the first measure of an animal's performance is its ability to survive.

CONVERSION TABLE FOR WEIGHTS AND MEASURES

(This partial list of weight and measure equivalents is included for the use of readers who may wish to convert from one system of weights and measures to another.)

Length	1 centimeter	=	0.3937 inch[1]
	1 meter	=	3.281 feet[1]
	1 kilometer	=	0.621 mile[1]
	1 inch	=	2.540 centimeters
	1 foot	=	0.3048 meter
	1 mile	=	1.609 kilometers
	1 Chinese foot	=	1/3 meter
Weight	1 kilogram	=	2.205 pounds
	1 metric ton	=	1.102 short tons
	1 metric ton	=	0.9842 long tons
	1 pound	=	0.4536 kilograms
	1 short ton	=	0.9072 metric tons
	1 long ton	=	1.016 metric tons
	1 catty	=	1/2 kilo

[1] Inches, feet, and miles are U.S.A.-British units.