CHAPTER 9

Animals in Hot Environments

Animal production and activity in a hot environment are particularly hampered by diminished feed intake and by the need to dissipate the additional heat associated with productivity under conditions of thermal neutrality or higher temperatures.

One of the effects of a high temperature is to diminish appetite, so that feed intake and consequently energy retention both decrease; this has led to the search for heat-adapted animals and means of enhancing adaptation to heat. Another approach to combating high temperatures is through environmental control, using shades and wallows to counteract the heating effects of the animal’s surroundings. Other difficulties facing animal production in hot regions of the world are the lack of suitable forage during some seasons and the high fiber content and low protein value of much of the available forage.

The need to dissipate additional heat arises because the partial efficiency of utilization of metabolic energy for growth is less than unity and is usually about 0.6–0.7. For each increment in energy retention, then, 30–40 percent of the associated metabolizable energy must be dissipated as heat. Under cold conditions, in contrast, although the partial efficiency of the growth process is similar, the excess heat production may be used as part of the greatly increased maintenance requirement and therefore may not appear as additional heat. It takes the place of some of the heat that the animal must otherwise produce to maintain its body temperature. At high temperatures, even in animals that are not growing or producing milk or eggs and that are therefore at the maintenance level of nutrition, the heat increment of feeding requires dissipation. Environmentally derived heat is added to the metabolic heat, which includes heat derived from activity, so that the total heat load requiring dissipation can be considerable.

Another disadvantage of hot regions is the high level of disease and parasite infestation. This is one factor that has led to unsatisfactory results in transferring such animals as cattle, sheep, and poultry from a
temperate to a hot climate. Growth rates, milk yields, egg production, and fertility all decline as a result of disease and lack of heat tolerance. Native breeds of animals are far better adapted to the environment and are more resistant to disease, but their levels of productivity are lower than those of selected animals raised in temperate climates.

**Hot Regions**

The hot regions of the world fall into two principal categories: the wet tropics and the deserts.

**Tropics**

Much of the earth's surface between 23° north and south of the equator is hot and humid and constitutes the tropics. These areas generally have two rainy seasons and two relatively dry seasons; air temperatures move between 22°C and 32°C, and the relative humidity is 50 percent during the day and approaches 100 percent at night. Although food is abundant and shelter is unnecessary for wild animals, the combination of uniformly warm environments and high humidities does not favor animal production. An additional disadvantage is the unchanging daylength, because coat changes, reproductive cycles, and metabolism are linked to photoperiodic seasonality. However, tropical zones, with their high rainfall and rich vegetation, do provide less direct solar heat load than the desert and support buffalo and beef cattle as productively used domestic animals (Moule, 1968). Indian cattle have been used extensively as meat-producing animals in Brazil; buffalo are indigenous to India, Burma, and Malaya, and there are many in China, where they are used for draft purposes and sometimes for milk.

**Deserts**

The deserts of the world are found in the latitudes from 15° to 32° north and south of the equator. They fall into three classes, cold, warm, and hot, all characterized by low rainfall and sparse vegetation. What vegetation does exist is scattered, and in the hot desert livestock are affected adversely by high daytime air temperatures and very high solar radiation levels, which can reach more than 1000 W/m². The arid regions occupy about 20 percent of the world's land surface, and the semiarid constitute a further 15 percent.

Although it is true that the primary characteristic associated with "desert" is relative lack of water, to consider the climate of the world's deserts only in terms of water shortage is to make an incomplete assessment. The survival of animals and plants in the desert depends on their ability to keep cool and to avoid desiccation and is influenced to a large degree by the 24-hourly fluctuation in temperature. This can be very marked, reaching 30°C or more in amplitude. This fluctuation is produced by clear skies with high intensities of solar radiation during the day and a high rate of reradiation from the earth's surface at night. The consequences are high air and surface temperatures during the day, and low air and surface temperatures that may approach freezing during the night. When the night temperatures fall below the dewpoint condensation occurs and water reaches the soil. An example of this effect is the growth of vegetation that occurs around telegraph posts in the desert; the growth is made possible by water condensing on the cooled post at night and running down to the ground.

Deserts, with their lack of water and plants, are clearly not compatible with considerable animal production, but many semi-desert areas in Africa, America, the middle east, Asia, and Australia are used for animal production. These areas merge with semiarid scrubland, which maintains numbers of ru-