Food for the buffalo

2.1 ENERGY AND PROTEIN REQUIREMENTS FOR BUFFALO

The most critical limiting quality parameter for herbivores is nitrogen (protein) (Sinclair 1977, White 1978, Mattson 1980, Ydenberg and Prins 1981, Berry and Louw 1982, Ketelaars 1986). Buffalo are herbivores, and, thus, to them nitrogen appears to be the most important food quality parameter too (Sinclair 1977). Ruminants are a special category of herbivores to which buffalo also belong. In ruminants digestibility of the food determines the throughput rate of the food in the gut. Digestibility itself depends on the nitrogen content of the food. Hence, in ruminants food intake is related to the nitrogen concentration of the food (Van Soest 1982). The most critical factor regarding the amount of food for herbivores is the density of the food on offer, that is whether it can be collected in the time that is available (Allden and Whittaker 1970, Stobbs 1973a,b, Short 1986). I will come to the problem of time limitation in Manyara buffalo later but will first discuss the buffalo’s energy and nutrient requirements.

To live, grow or reproduce, an animal needs energy and nutrients. These requirements have to be met by the ingested food. In Chapter 1, I showed that for the Manyara buffalo this food consists mainly of grasses. Two of the most critical requirements are energy and protein, and intake can be expressed in the same terms, namely as metabolizable energy (kcal or J) and digestible protein (kg). Intake of nutrients and energy can be expressed as the product of the quantity of ingested food (kg day⁻¹) and its quality (concentration of nutrients, kg kg⁻¹ or percentage; or of digestible energy, kcal kg⁻¹). Because of the tremendous importance of the livestock industry, much research has been carried out in describing feeding standards for domestic animals such as cattle, and I have drawn on those results for describing the requirements of buffalo. However, this information is also relevant for other herbivores. I have assembled most of the available information in the Appendix. With these formulas, the food intake of buffalo (in terms of both digestible protein and metabolizable
Energy and protein requirements for buffalo

energy) can be deduced to depend on the crude protein concentration of the food. The importance of crude protein in the buffalo’s food is emphasized by the fact that the crude protein content in fistula samples explains 54% of live weight change in cattle under African range conditions (in Botswana), while the protein content of clipped samples explains 48% of live weight change; digestibility explains less variance (Pratchet et al. 1977). Here lies a bone of contention:

the influence of the crude protein content and digestibility are in disagreement with workers in temperate climates, who found that energy is the major limiting factor, but are in agreement with many workers in the tropics and subtropics. Energy is not the first limiting factor in dry grasslands [in Africa].

(Pratchet et al. 1977)

In the Appendix, I have tried to find a means to link the crude protein content to the energy content of the food plants. It will be clear that grazing buffalo have to satisfy their needs for energy and protein simultaneously. The most economic way of achieving this is by reaching an optimal balance between the requirements for energy and for protein. Thus, I have constructed nomograms to determine the most economic crude protein concentration in the food for classes of adult buffalo (Figure 2.1), leading to the identification of a ‘balanced diet’.

Adult non-lactating cows need 24 g digestible protein (DP) per 1000 kcal metabolizable energy (ME). For juvenile animals (that is 30% of adult body weight) the balanced diet has to provide 40 g DP for 1000 kcal ME, and for lactating females this has to be 32 g DP for 1000 kcal ME (Crampton and Harris 1969, p. 211 ff., Lloyd et al. 1978, p. 435 ff., Barrett and Larkin 1974; Table 6.1). It can now be shown that a low-quality diet provides an excess of energy in relation to protein, and that for maintenance requirements the crude protein concentration in the food has to be approximately 6.2% but that for a balanced diet the crude protein concentration has to be 9.0%. If the crude protein concentration is higher then protein is in excess. For a lactating buffalo cow, a diet containing 8.5% crude protein covers maintenance requirements while at 11.4% crude protein the diet is balanced.

I have assumed that wild African buffalo are physiologically the same as cattle, just as Sinclair (1977) and Demment and Van Soest (1985) did. Hence, I have assumed that the buffalo’s needs and digestion efficiency can be legitimately derived from studies in cattle. Although wild bovids such as bison and water buffalo are reported to have a (slightly) higher digestibility efficiency than domestic cattle and zebu (for example Johnson et al. 1967, Naga and el-Shazly 1969, Pant and Roy 1970, Verma et al. 1970, Hawley et al. 1981 but see Chaturvedi et al. 1973), this difference is most likely to be due to these wild bovids being larger than cattle.