

Book review

The Mineral Nutrition of Livestock, 3rd ed. E. J. Underwood and N. F. Suttle. Wallingford: CABI Publishing. 1999. £75.00 ISBN 0-85199-128-9

In terms of textbooks, the nutrition of the major minerals and trace elements is not as well served as, for example, the vitamins. Underwood established this book as the leading comprehensive source in the field in its first two editions and although the second edition (1980) has remained a valued source, the arrival of this third edition is welcome and re-establishes the text to its rightful place. Following Underwood's death it must have been tempting to resort to a multi-author treatise for updating such a large and diverse subject, but Suttle chose to tackle the task alone (with acknowledgements of help from several eminent colleagues) and this, in addition to giving consistency of treatment, has allowed him to retain much of the feel of Underwood's earlier editions. The extent of the updating may be judged by the increase to 614 from the 180 pages of the second edition. A small part of the increase is perhaps due to the less frugal style of presentation, which adds considerably to the attractiveness of the book.

A book such as this may be seen and used as a rich source of detail on the individual elements, but to dip only into those chapters is to miss much in the general chapters. The first three chapters retain essentially the structure and flavour of Underwood's original, but are much enlarged. Those who struggle to understand and teach concepts such as factorial requirements as related to minerals, the perennial problem of availability and the extent and range of mineral interactions will be grateful for this source; the explanations are clear and well structured while not hiding the complexity of the material. In one respect at least it is certain that Chapter 3 (The detection and correction of mineral imbalances) will have to be read, for here a general model of events during mineral insufficiency is introduced. The model, *viz.*, depletion, deficiency, dysfunction and disease, related to storage, transport, function and clinical signs, recurs in subsequent chapters including specifics for each individual element. An addition to the general chapters is a final chapter on 'Design of supplementation trials . . .', twelve pages of required reading for experimenters in this field.

It is impossible to do justice to the fifteen chapters dealing with the individual elements. Suttle mentions his trepidation at changing features of Underwood's original structure. Readers will now find that within chapters the elements are dealt with under sources, metabolism, function, deficiency and disorder, requirement and excess. Those familiar with texts on vitamins will recognise this approach.

The other changes are reflected in the chapter subjects and contents. Ca and P are separated, a development which recognises the growth of information, especially in the case of P, and that while there is close association between the two elements in relation to bone, in other areas it is

unwieldy to try to maintain the connection. Increasing knowledge of vitamin D has underpinned developments in Ca nutrition and this is apparent, for example, in the approach to exploring observations illustrating regulation of Ca absorption in relation to requirement. Regulation of absorption is but one of the recurrent themes in the chapters and serves to remind the reader of how little is known with certainty about the mechanisms of such nutritionally important phenomena. Na and Cl are separated from K, but the three are brought together in considerations of acid-base balance, a subject that has received much attention in both ruminant, in relation to milk fever, and non-ruminant animals since the last edition of the book.

Another departure is a chapter devoted to S, in recognition of its importance in ruminant animals. Co too is dealt with strictly in the ruminant context. As would be expected of Suttle, Cu and its interactions with S and Mo in ruminants are richly treated. Cu toxicity also receives its due attention. There follows a series of chapters on the other 'classical' trace elements. Understanding of I and Fe has benefited from the importance attached to them in human nutrition, although, especially in the former case in such areas as goitrogens and practical feeding problems, this book shows that there is much information specific to animals. Mn has remained much more in the province of animal nutrition, and understanding of its absorbability and metabolism is emerging to add to the relatively familiar material on functions. Se, having been of concern in animal nutrition for some years, emerged as a popular subject of research after discovery of responsive conditions in people and then the development of the antioxidant hypothesis. The book is a useful introduction to the more recently discovered selenoenzymes, such as the phospholipid form of glutathione peroxidase and the thyroid hormone deiodinase. The treatment of Zn emphasises its role in gene expression and draws particular attention to its role in appetite. A problem with investigation of the latter would seem to be separating the specific from the general observation that most nutrient deficiencies affect food intake adversely in animals.

The remaining elements are treated in two chapters: 'Occasionally beneficial elements' (B, Cr, Li, Mo, Ni, Si, Sn and V) and 'Essentially toxic elements' (Al, As, Cd, F, Pb and Hg).

This book is excellent value. It will repay constant revisiting. Ranging as it does from the fundamentals to practical concerns while serving also the valuable function of gathering together knowledge on mineral contents of feedstuffs and nutrient requirements, it must become a standard text in the animal nutrition and veterinary library. It can also be recommended as a source to all interested in mineral nutrition, metabolism and function.

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