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Book Review

INRA Feeding System for Ruminants, INRA (Ed.), Wageningen Academic Publishers, P.O. Box 220, NL-6700 AE Wageningen, The Netherlands (2018). 640 pp., paperback, EUR 79.00, USD 99 ex VAT, ISBN: 978-90-8686-292-4.

Feeding systems are important tools for animal nutritionists. The French INRA (Institut National de la Recherche Agronomique) has a very long history of developing and publishing feeding systems. The first edition of the “Livre Rouge” was published in 1978 under the supervision of R. Jarrige; later (1988; 1999 and 2007), some updates followed and incorporated new knowledge in animal nutrition.

Now, 40 years after the first publication of the INRA Feeding System, livestock farming has changed dramatically. The former main objective of maximum productivity per animal has been replaced by the contemporary requirements to increase the efficiency of feed use, to control the herd health, to consider environmental impacts as well as the quality and safety of animal products. The new INRA feeding system for ruminants presents the whole system for dairy and meat producing ruminants, be they large or small, and it includes specificities for tropical and Mediterranean areas. The new system is mainly developed from meta-analyses of large data bases, available in INRA-institutes, and modelling. The dietary supply model accounts for digestive interactions and flows of individual nutrients, so that the feed values of feeds and nutrients depend on the final ration.

The book is well structured, beginning with an introduction and followed by four sections of 26 chapters altogether. The book is an impressive team work, written by 34 scientists, 27 from INRA-institutes and 7 by other French scientists. After the table of contents, an extensive glossary (8 p.) explains most of the abbreviations used in the book (but the term “INRA” is not explained).

A foreword by J.L. Peyruet (Agriculture Scientific Director of the INRA) and a General introduction (Chapter 1; 4 p.) prefaces the book. Context and objectives, methods, main advances and the content of the book are described in the general introduction. The book is well-structured and contains a large amount of valuable information about ruminant nutrition. At the end of the book, the reader finds details about the databases (all together 17) used in the book, followed by a list of references for all papers (32 p.) and finally a short index (3 p.).

Section 1 is titled “The dietary supply” and covers the following four chapters:

2. Feed intake (10 p.)
3. Energy supply (17 p.)
4. Protein and amino acids supply (17 p.)
5. Minerals, vitamins and water supply (10 p.).

These chapters describe the foundations of animal nutrition and are the basis for the following chapters.

“The animal’s requirements and responses to diets” is the title of Section 2. It includes ten chapters with the following titles:

6. Energy expenditures, efficiencies and requirements (28 p.)
7. Protein and amino acid expenditure, efficiency and requirements (19 p.)
8. Minerals, vitamins and water requirements (9 p.)
9. Dry matter intake and milk yield responses to dietary changes (26 p.)
10. Growth response to dietary changes in growing-finishing animals (8 p.)
11. Milk fat content and composition (7 p.)
12. Fatty acid composition of muscles (9 p.)
13. Faecal and urinary nitrogen excretion (5 p.)
14. Enteric methane emissions (4 p.)
15. Digestive welfare and rumen acidosis (6 p.).

Most of these papers deal with energy and nutrient requirements of ruminants, but some texts also demonstrate the influence of feeding on growth response, composition of milk and body samples, the N-excretion and the methane emissions. Animal health and welfare and disturbances of rumen metabolism are analysed in the last chapter.

The 3rd section has the headline “Practices for rationing” and summarizes important knowledge about feeding concerning the most important groups of ruminants. This section is subdivided into seven chapters:

16. General principles of rationing (10 p.)

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17. Dairy cows (36 p.)
18. Beef cows and calves (20 p.)
19. Growing and finishing cattle (29 p.)
20. Dairy, growing and fattening sheep (19 p.)
21. Dairy and growing goats (26 p.)
22. Specificities of feeding ruminant livestock in warm areas (25 p.)

The authors of the contributions in section 3 deal with practical feeding of growing and lactating ruminants under consideration of animal requirements treated in section 2. Special attention is paid to the ruminant feeding under tropical conditions.

Section 4 has the title “The reference values of feed: tables and prediction” and has four chapters:

23. Methods for feed evaluation and databases (6 p.)
24. Calculation of feed values in INRA system: feed tables and prediction equations (29 p.)
25. INRA feed tables used in France and temperate areas (108 p.)
26. INRA feed tables for warm areas (37 p.)

These chapters are very important for the users. The feed tables contain a lot of information about all kinds of feed groups, such as fresh forage, silages, hays, straws, stover and husks, roots and tubers and many concentrate feeds. All values are given per kg DM.

Many parameters of important feedstuffs are summarized here, such as dry matter content, or the energy values UFL (Net energy for lactation) and UFV (Net energy for meat production). Apart from the protein values PDIA (Truly digestible dietary protein), PDI (Truly digestible dietary and microbial protein), RPB (Rumen protein balance) and Lysine and Methionine, the reader also finds parameters of different Fill values, namely UEL (Fill value for dairy cows and dairy goats), UEB (Fill value for growing cattle and suckling cows) and UEM (Fill value for sheep). Furthermore, there are the following organic feed constituents: Organic matter, Crude protein; Crude fibre; NDF (Neutral detergent fibre), ADF (Acid detergent fibre); FA (Fatty acids), Ether extract, and also the minerals P (Phosphorus), Ca (Calcium), Mg (Magnesium). Finally, the EB (Electrolytic balance; calculated in mEq/kg DM); is shown, followed by GE (Gross energy) and ME (Metabolizable energy), both presented in kcal/kg DM.

It is surprising that the INRA did not consider the International System of Units (SI-system) in energetic measurements.

All the chapters are underlined with many equations, 137 tables as well as 136 excellent and instructive figures. The design layout is clear and makes it easy for the reader to find through the material. For instance, the different chapters are marked in black at the side of the book, so that the reader can quickly find the one he is interested in.

The book is an extremely valuable tool for all scientists interested in ruminant feeding. The text offers the basic principles and new developments in feed evaluation for ruminants. In this new edition, emerging challenges for animal nutritionists are addressed in a considerably improved way. It takes greater account of animal health, product quality and safety as well as emissions to the environment. Many aspects are considered also under breeding contexts, now.

The book can be recommended for teaching and research of graduate students at the master and PhD levels in animal sciences, but also in ecosystem sciences, management and veterinary medicine for students all over the world. Furthermore, the book will also be of use to practicing nutritionists and people in the feed industry who are seeking advanced information on applied nutrition and wish to understand biological and nutritional modelling of nutrient requirements by ruminants and nutrients supplied by feedstuffs.

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