

NRC releases horse revisions

The National Research Council equine committee reviewed literature on equine nutrition and compiled a very useful and practical document for calculating nutrient requirements for various classes of horses.

By **JOE D. PAGAN***

THE much-anticipated sixth revision of the National Research Council's (NRC) *Nutrient Requirements of Horses* was recently published by the National Academies Press.

Since the fifth revision in 1989, a substantial amount of research has been conducted in the areas of equine nutrition and exercise physiology. The new revision includes a thorough review of the literature, resulting in a publication that is more than three times longer than the 1989 edition. There is also a free downloadable computer program (nrc88.nas.edu/nrh) that can be used to calculate nutrient requirements and compare nutrient intakes from a selection of forages, grains and mineral sources.

Several chapters that are particularly relevant to the feed industry have been included in the new revision. A chapter on feed and feed processing includes an extensive discussion of forages and factors affecting forage composition. Grains, byproduct feeds, protein supplements, vitamin supplements and mineral supplements are also discussed. Additionally, the effect of feed processing on nutrient digestibility and site of nutrient absorption is reviewed. Another chapter describes feed additives such as colors, antioxidants, flavors and pellet binders that affect feed characteristics as well as additives that are intended to affect animal health.

Documentation from the scientific literature on the efficacy of commonly used dietary supplements in horses such as antioxidants, direct-fed microbials, yeast culture, enzymes, herbs, joint supplements and omega-3 fatty acids is included.

*Dr. Joe D. Pagan is president and founder of Kentucky Equine Research Inc., which, through consultation and research, aims to bridge the gap that may exist between basic research and horse production.

The committee was careful to state that a "discussion of such supplements does not imply essentiality but only serves to provide information on which to base an informed decision as to whether or not to use such substances in diets provided to horses." However, it remains unclear who will make those informed decisions: the horse owner, the supplement manufacturer, state feed regulatory agencies or the Food & Drug Administration.

With one notable exception, the new revision employs a much more comprehensive system of describing horse classes than previous editions. Mature, non-working horses are now divided into three categories based on differences in activity and metabolic rate. Stallions are classified into breeding and non-breeding categories, and a fourth category of exercise has also been added.

The greatest change in physiological status occurred with the mare in mid-

pregnancy. The 1989 edition assumed that a pregnant mare's nutrient requirements were unchanged from maintenance until the ninth month of pregnancy. The new edition recognizes that fetal growth significantly affects maternal nutrient requirements as early as the fifth month of pregnancy and adjusts recommended nutrient intakes to coincide with fetal growth. Individual recommendations were also made for each month of lactation rather than dividing lactation into early and late periods, as in previous editions.

The one area where the new edition simplifies recommendations was during growth from 4 to 12 months of age. Previous NRC editions made recommendations for two rates of growth, but the new NRC makes recommendations for a fixed growth rate that is calculated from a single growth curve designed to represent all sizes and breeds of horses. The new NRC computer program does not allow the user to override this calculated growth rate for a specific age and mature body size, making it difficult to use the program to manipulate growth rate to manage individual foals.

Digestible energy

Digestible energy (DE) guidelines



for maintenance and exercise in the new edition are generally similar to the previous edition except for the broadened classifications discussed above. DE requirements for pregnancy in light horses increased from 4 to 12% during mid-pregnancy and from 5 to 10% during the last trimester.

Stallions are considered to have a 10% higher maintenance DE requirement than mares or geldings. The DE requirement for stallions in heavy breeding use is estimated to be 20% higher than maintenance.

DE requirements for growth remained largely unchanged from the previous edition although new equations based on a number of recent research studies were used to make the calculations.

The largest change in DE requirements occurred for lactating mares, which were increased from 8 to 21%. This increase resulted from a combination of a higher maintenance DE requirement and a higher estimate of milk production than those used in previous editions.

Protein

Generally, protein requirements were lowered in the new revision due in large part to assumptions of higher protein digestibility and quality compared to the previous editions.

Protein requirements for work were significantly reduced from the previous edition. These new requirements were based on estimates of muscle gain and nitrogen losses in sweat at various intensities of exercise rather than as a fixed ratio of protein to energy intake, which was used in the previous edition.

Protein requirements for exercise in light horses were suggested to increase over maintenance by 11, 22, 37 and 59% in light, moderate, heavy and very heavy exercise, respectively. Protein requirements for growth were also reduced 6-16% in weanlings and yearlings and by a greater amount in long yearlings and two-year-olds that are also in training.

Macro-minerals

Calcium and phosphorus requirements for growth were increased substantially in the new edition based largely on increased estimates of endogenous losses in growing horses. Both calcium and phosphorus requirements were elevated 15-20% in weanlings and yearlings, and these requirements were increased 37-56% in long yearlings and two-year-olds.

Electrolyte requirements for exercised horses were calculated based on sweat losses in the new edition. It was assumed that horses in light, moderate, heavy and very heavy work would lose 0.25, 0.50, 1.0

and 2.0% of bodyweight as sweat per day.

Since sweat loss can vary tremendously depending on relative humidity and environmental temperature, it is advisable to adjust estimates of sweat loss in extreme environmental conditions.

Micro-minerals

Most of the new recommendations in the sixth revision — including DE, protein, macro-minerals and vitamins — are calculated on a bodyweight basis. Conversely, all of the micro-mineral recommendations except copper are calculated as a concentration of dry matter intake, as in previous editions.

The daily nutrient requirement tables in the text make these calculations based on a fixed dry matter intake for each class of horse. The computer program, however, calculates the requirements based on the level of dry matter intake selected by the user, resulting in different micro-mineral requirements for different dry matter intakes.

The physiological relevance of this method of calculation is questionable, and it would be prudent to use NRC's recommended dry matter intakes when making these calculations with the computer program.

The largest single change in any nutrient requirement in the new edition was for iodine. The text of the 1989 NRC estimated the iodine requirement of horses to range from 0.1 to 0.6 mg/kg of diet but used 0.1 mg/kg to calculate individual iodine requirements. The new revision uses 0.35 mg/kg diet for most classes of horses and increases the requirement for the last trimester of pregnancy to 0.4 mg/kg dry matter.

The copper requirement for growing horses and pregnant mares has been a controversial issue since the mid-1980s, when a survey conducted by Ohio State University of feeding practices on breeding farms in Ohio and Kentucky suggested that the level of copper intake needed to prevent skeletal disease in foals was much higher than the 9 mg/kg diet recommended by the 1978 NRC edition.

The committee responsible for the 1989 edition concluded that there was not enough controlled scientific evidence to warrant a large increase in this requirement and chose to raise the copper requirement for growth to only 10 mg/kg diet. Since 1989, a number of studies have addressed this issue, and it has become generally accepted in the feed industry that the copper requirement for growth and pregnancy is considerably higher than that recommended by NRC.

Surprisingly, the new NRC committee

chose to leave the requirement for growing horses equal to 10 mg/kg diet or 0.25 mg/kg bodyweight.

The requirement for pregnancy was also set at 0.25 mg/kg bodyweight, which equates to 12.5 mg/kg diet dry matter for a mare consuming 2.0% of her bodyweight.

One recommendation made by the new edition raises some interesting regulatory issues. Silicon had not previously been considered an essential nutrient for horses.

The new edition reviewed research conducted with silicon since the 1989 NRC and concluded, "Difficulty in producing a silicon-deficient purified diet for horses will make determining a minimum requirement difficult, though a need for silicon in the ration likely exists for the equine."

The only source of silicon cited as being bioavailable and effective was sodium zeolite A (SZA). Presently, SZA is not considered by the Association of American Feed Control Officials to be a dietary source of silicon, and SZA is approved for use in animal feed only as a flow agent. It will be interesting to see how these new recommendations affect silicon's regulatory status in the future.

Vitamins

Recommendations for vitamins (A, D, E, thiamin and riboflavin) remained largely unchanged from the previous edition except that they are now expressed as a function of bodyweight rather than as a concentration in the ration. A number of other vitamins (K, niacin, biotin, folate, B₁₂, pantothenic acid, B₆ and C) were discussed, although no specific requirements were suggested.

Summary

Overall, the committee for this new revision did a fine job of reviewing the literature related to equine nutrition and compiled a very useful and practical document for calculating nutrient requirements for various classes of horses.

Some of the new recommendations such as those for mid-pregnancy are certainly more correct and useful than in previous editions. Others, such as the recommendations for many of the micro-minerals, will probably be ignored by a large sector of the feed industry.

Regardless, the sixth revision of the NRC *Nutrient Requirements of Horses* should be an essential addition to the library of anyone with an interest in equine nutrition. The book can be purchased online at www.nap.edu.