Kentucky Equine Research®
World Leaders In Equine Nutrition

Advances in Equine Nutrition

Volume II

Edited by

J.D. Pagan

STUDIES OF PASTURE SUPPLEMENTATION

D. S. KRONFELD[1], W. L. COOPER[1], K. M. CRANDELL[1], L. A. GAY[1], R. M. HOFFMAN[1], J. L. HOLLAND[1], J. A. WILSON[1], D. J. SKLAN[2], P. A. HARRIS[3], W. TIEGS[3]

[1] *Virginia Polytechnic Institute and State University, Blacksburg, VA*

[2] *Hebrew University, Rohovot, Israel*

[3] *WALTHAM Centre for Pet Nutrition, Leicestershire, UK.*

Pastures provide the habitat, including much of the food, for about 80% of commercially active horses in Virginia. Pasture composition varies with type of soil, botanical composition, and season of the year. It is unlikely to provide energy and nutrients in optimal amounts and proportions for growth and reproduction. Therefore, most pastures require supplementation to provide diets with energy sources and essential nutrients in optimal ranges.

Although pasture is regarded as the main source of roughage or fiber for grazing horses, the actual fiber content fluctuates through the seasons and is marginal or too low in rapidly growing plants and in frost killed plants. At these times, overloads of soluble carbohydrates favor production of lactic acid rather than acetic acid, hence decrease metabolic efficiency (seen as a growth slump) and increase the risk of digestive upsets (osmotic diarrhea, colic, enteritis), metabolic disorders (laminitis, rhabdomyolysis, osteochondrosis). Thus, a flexible pasture supplement should provide a full spectrum of carbohydrates to promote a microbial population capable of adapting readily to changes in pasture composition.

In mature pastures, in contrast, too much fiber lowers the intake of sufficient food energy. This potential weakness is exacerbated by a supplement high in fiber (~2 Mcal/kg), so fats or oils (~9 Mcal/kg) are needed to raise the energy density to about 3.0 Mcal/kg, which is usual for a supplement.

For flexibility, a pasture supplement's contents of protein, vitamins and minerals should be designed using *sensitivity analysis* to cover wide ranges of forage composition and supplement:forage ratios.

Studies

- **Pasture composition.** Ranges of nutrients in pastures and hays from central and north-central Virginia were determined throughout the year to assess seasonal changes.

- **Carbohydrates.** The typical DHIA Forage Lab proximate analysis of carbohydrates was considered unsuitable for our hindgut fermenter. *Hydrolyzable carbohydrates* (CHO-H) were analyzed enzymatically on 130 pasture samples and 30 grains. Now CHO-H can be predicted by a simple regression on nonstructural carbohydrates (NSC).

- **Corn oil.** Preference tests demonstrated higher *palatability* (voluntary acceptability) of corn oil than other vegetable oils and animal fats. Tests of spontaneous activity and reactivity demonstrated *calmness* to be improved by dietary corn oil and mixtures of soy lecithin and corn oil.

- **Spring slump.** A slump in growth rate in March-April can be seen in data from Ontario, KY and VA for pastured yearlings fed typical supplements — corn, soybean meal and molasses (starch-and-sugar, SS). This slump can be prevented by feeding our fiber-and-fat supplement (FF). The slump may be attributed to overloads of hydrolyzable and rapidly fermented carbohydrates.

- **Glycemic index.** Exaggerated responses of blood glucose and insulin to a grain meal have been found in horses with developmental orthopedic disease (DOD) by Dr. Sarah Ralston (Rutgers). The glycemic index is much lower for FF than SS, so the risk of DOD should be lower with FF than with SS.

- **Vitamins.** Vitamin A status was determined by serum retinol concentration and, more sensitively, by a relative dose response (RDR) test. Vitamin A depletion developed in pregnant mares during winter, and was counteracted by supplementation with vitamin A at twice the NRC requirement (but not by a water-dispersible form of ß-carotene). Vitamin A deficiency resulted in low birth weight foals and more frequent retained placentas and contracted tendons. Other vitamins are included at twice NRC minimum requirements.

- **Minerals.** Analysis of forage samples, initially 20, then 33, finally 130, determined the range of mineral contents; P, Zn, Cu and Se were frequently marginal or deficient. The mineral premix was designed, using *sensitivity analysis*, to provide 1.5- to 3-times the NRC minimum requirements, taking into account the variation found in 130 forage samples and a range of supplement:forage intakes of 25:75 to 50:50. These forages were grasses or grass and legume mixtures with no more than 33% legumes. (A different mineral premix would be needed for alfalfa hay.)

- **Protein.** Initial protein content was simply the optimal value, 50 g/Mcal DE, to provide maximal growth rate determined by fitting a parabolic curve to data in the literature. Subsequent studies have tested fortification with lysine and threonine of 20 g/Mcal protein, which would minimize contamination of the environment.

- **Markers.** A limiting factor in pasture research and supplement design is the imprecision of estimating pasture intake (PI) by difference. Better estimates may be obtained by marker methods that measure fecal output

(FO) and digestibility (D): PI = FO/(1 - D). We have developed a chromic oxide method for measuring FO. Currently being tested to measure D are alkanes, yttrium, and NIRS predictions from feeds and from feces.


Kentucky
Equine
Research®