

Defining Quality in Alfalfa (Deconstructing the Plant)

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Alfalfa nutrient components play a role in the growth of the plant, as well as the nutrition of the ruminant animals consuming it. Despite the fact there is no symbiotic relationship between alfalfa and ruminants, the nutrient composition of alfalfa complements the nutritional requirements of ruminant animals surprisingly well. We know more about the role of some nutrient components (Neutral Detergent Fiber, NDF; Rumen Undegraded Protein, RUP; Starch, Fat, Minerals) than we do about others (Pectin; Water Soluble Carbohydrates, WSC; Rumen Degraded Protein, RDP). Lab analysis of 1070 samples of freshly cut alfalfa samples, hand-harvested from various locations across the United States from 2019-2022 demonstrates the size and range of these various nutrient fractions (expressed as a percent of dry matter). Fat and minerals are not discussed but were accounted for in calculations.

We know the most about the largest of these fractions, NDF ($33.5\% \pm 5.5$), and its digestibility (NDFd; 49.4% of NDF ± 4.9), since taken together and expressed as Ruminant Undigested NDF (RuNDF) it can have a profound impact on intake, feed passage rate through the rumen, and subsequent ruminal digestion of the entire diet. As a forage, alfalfa is well suited in this respect since its RuNDF content is relatively low, compared to most other forages, because of its moderate NDF content, coupled with its high rate of NDFd. Recent genetic modification of the lignin content in alfalfa has allowed greater flexibility in fine-tuning this advantage.

Crude protein (CP; $22.8\% \pm 3.2$) is another of alfalfa's important nutritional contributions, comprised of RUP and RDP. RUP is a direct contributor to the essential metabolizable protein (MP), or "absorbed" protein supply to the ruminant animal and has been studied extensively. However, no comprehensively validated laboratory method exists for its measurement. This is a significant need, since it would also allow for the calculation of alfalfa RDP (i.e., CP minus RUP) which is rich in peptides. Peptides have been shown to improve synthesis of microbial protein in the rumen, which is another important contributor to the ruminant's MP supply.

The least understood of alfalfa's carbohydrate fractions are the non-fiber carbohydrates: starch, pectin, and WSC. While starch constitutes a relatively small fraction ($2.9\% \pm 2.1$), pectin (considered by many as "soluble fiber") and WSC taken together constituted an average of 28% of the dry matter in this sample set. While we consider these fractions as "benign" energy sources, they warrant further study for potential beneficial effects on rumen function.

With some predictability, we can modify the nutrient composition of alfalfa through variety selection, as well as management of the crop during growth, harvesting and storage. The key is possessing an understanding of how to use laboratory quality measurements to manage the alfalfa crop to the best advantage of the ultimate consumer, the ruminant animal.

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