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Protein Supplies for Beef Cattle Diets

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Although protein supplementation is often a high cost item in beef cattle feeding program, there are some situations where protein supplementation is needed to meet the animal’s nutrient requirements. Forages serve as a key source of protein in Mississippi beef cattle operations. Several types of supplemental protein sources are also available for beef cattle diets. Prices, forms, and protein content of forages and supplements vary widely.

Protein from Forages

Beef cattle diets in Mississippi are primarily forage based. The protein composition of forages typically varies by forage species, soil nutrients, and forage maturity. Cool-season forages tend to contain higher crude protein levels than warm-season forages (Table 1). Crude protein concentration also generally decreases with increasing forage maturity and decreasing nitrogen fertilizer rates.

Table 1. Forage crude protein typical ranges by forage species and stage of maturity

Forage	Stage of Maturity	Crude Protein, % of dry matter¹
Alfalfa	Bud	22 – 26
	Early flower	18 – 22
	Mid bloom	14 – 18
	Full bloom	9 – 13
Corn Silage	Well eared	7 – 9
	Fair to poorly eared	7 – 9
Tall fescue, orchardgrass	Vegetative – boot	12 – 16
	Boot – heat	8 – 12
Annual ryegrass	Vegetative – boot	12 – 16
	Boot – heat	8 – 12
Bermudagrass	4 week old	10 – 12
	8 week old	6 – 8
Pearl Millet, sorghum-sudangrass		8 – 12
Red Clover	Early flower	14 – 16
	Late flower	12 – 14
Annual lespedeza		12 – 16

¹Forages containing >19% crude protein are considered Prime quality, while forages <8% crude protein are classified in the lowest quality standard.

Source: Adapted from Ball et al., 2007. *Southern Forages*. 4th edition.

Insufficient protein can be a problem on warm-season grasses receiving inadequate nitrogen fertilization, particularly when forage is allowed to become mature before harvest or when frosted pasture is grazed during winter. Excessive rainfall can also leach nitrogen from the soil and reduce nitrogen levels available for plant protein production and animal consumption.

Limiting dry matter intake on poor quality forages is another concern with regard to the crude protein content of the diet. Generally, forage dry matter intake as a percent of body weight increases until forage crude protein content as a percentage of dry matter decreases below a threshold of about eight percent (Figure 1). Thus, if a minimum of eight percent crude protein is not maintained in forage crops, cattle will decrease consumption of these poor quality forages.

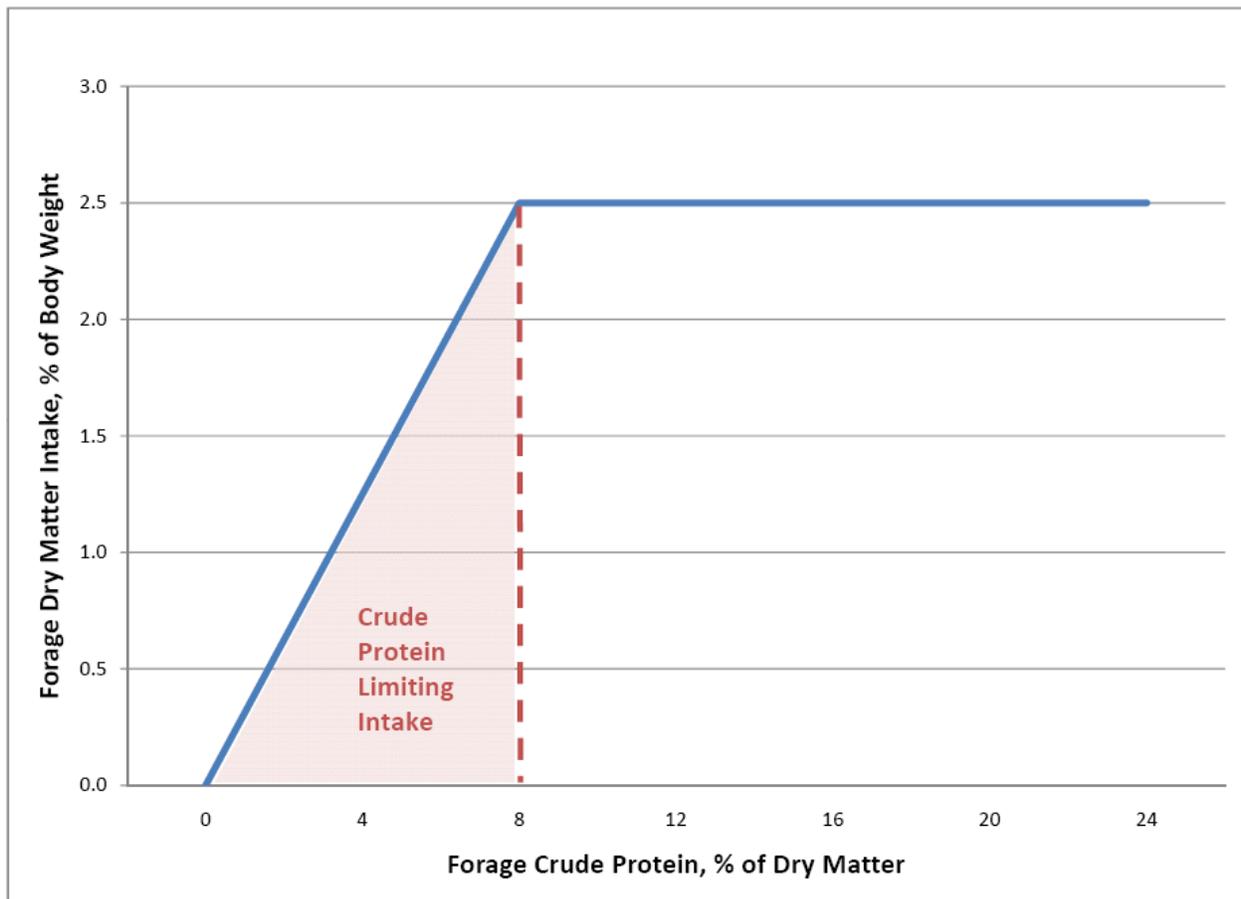


Figure 1. Forage dry matter intake relative to forage crude protein concentration
Source: Adapted from Moore and Kunkle, 1995.

When crude protein is below eight percent, rumen bacteria responsible for digesting forage cannot maintain adequate growth rates. Forage intake and digestibility will then decrease. Crude protein supplements are appropriate under these conditions to stimulate forage intake.

Forages with adequate levels of crude protein will not require protein supplementation to improve intake but may need crude protein supplementation if cattle nutrient requirements for crude protein are not being met by the forage alone. If the forage supplies at least eight percent crude protein, then forage intake will likely decrease with

the addition of protein supplements fed at a rate of 0.3 percent of body weight or more as a substitution effect takes place. Forage quality testing is an invaluable tool for determining stored forage crude protein concentrations in advance of feeding.

Protein Supplements

Protein supplements are available in many forms. High-quality forages, commodity co-product feedstuffs, range cubes, protein blocks, and liquid supplements are some examples. Examples of feedstuffs (and their typical protein concentrations on a dry matter basis) that can serve as effective protein supplements include soybean meal (48%), cottonseed meal (41%), whole cottonseed (24%), corn gluten feed (24%), dried distillers grains (27%), and brewers grains (26%). Dried distillers grains have the added benefit of containing relatively high in undegradable intake protein (bypass protein) levels.

Consider cost per unit of protein and convenience of various protein supplements. Base purchasing decisions on the cost per pound of protein instead of the price per pound of supplement. Product labels indicate the protein percentage and how much protein is in the form of non-protein nitrogen. Convenience products often contain non-protein nitrogen (NPN) and are generally higher in price per unit of protein. Be sure to read all feed tags checking for NPN content in range cubes, protein blocks, and liquid supplements in particular.

The molasses content of liquid supplements is usually not high enough for proper NPN utilization when supplementing low quality forages. Similarly, while protein requirements are often met by both liquid supplements and protein blocks, these supplements rarely provide adequate amounts of supplemental energy for lactating cattle fed hay. Mississippi forage test results indicate that energy more often is the limiting nutrient in meeting beef cattle requirements than protein. Monitor body condition or average daily gains and adjust energy supplementation as needed.

Consider using high quality forages such as vegetative legumes and cool-season forages to supply protein in beef cattle diets when possible. Use commodity-based co-product feedstuffs to supplement forage-based diets for stocker calves and lactating cows for the best supplement values if the operation is set up to store and handle these feeds. For more information on beef cattle nutrition or related topics contact a local office of the Mississippi State University Extension Service.