Ministry of Agriculture and Fisheries
Hon. John Savage, Minister

Factsheet

BC

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FORAGE PROTEIN AND ITS USE

Effects of Forage Maturity on Forage Protein Levels

Protein is one of the components of forage quality that is possible to control. Maturity is the main factor influencing protein content. Early harvest results in higher protein values. As plants mature, especially grasses, their protein content declines quite rapidly. Legumes such as clover and alfalfa tend to have higher protein values than the grasses and may retain their protein values at advanced maturity. Nitrogen fertilizers will have an effect on improving the protein content of grasses but will have minimal influence on legumes, other than to deplete their content in a forage stand.

Table 1: Effect of Maturity on Yield and composition -- Alfalfa

Stage	Yield (kg/ha)	% CP	Digestible DM (kg/ha)
Prebud	7460	16.1	4595
Full bud	7423	16.3	4720
Early bloom	8323	15.2	4930
10% bloom	8570	14.9	5000
Mid bloom	9303	13.7	5200

McLeod, Can. J. Plnt Sci. 52:941

Table 2: Effect of Maturity on Yield and Composition -- Orchardgrass

Stage	Yield (kg/ha)	% CP	Digestible DM (kg/ha)
Boot	5530	15.0	3631
Heading	6805	13.0	4000
Early flower	7274	11.6	4153
Flowering	8195	11.0	4133
Early seed	6833	10.9	3948

Can. J. Plnt Sci. 54:55

Effects of Harvest and Conservation on Forage Protein Levels

Any factor that will cause leaf loss during harvest will reduce protein content. Raking and weather damage are the two main culprits in reducing the protein content of forages.

Even when silages are wilted one can detect differences in protein content. Grass at 19.2% dry matter still has losses of leaf that results in reduced protein being harvested. One should also note from Table 3., that when the grass at 39% dry matter was ensiled, the protein content appeared to increase. This could be attributed to the loss of soluble sugars as carbon dioxide in the fermentation process, resulting in a concentrating effect on the protein and other less volatile compounds. The true protein content was also reduced by the fermentation. Under extremely wet conditions, the non-protein nitrogen component of the silage would shift from the amino acid to the ammonia fraction. High ammonia levels in silage are indicative of silage with poor intake potential.

Table 3: Effect of Conservation Wilting of Silage

Wilting	Dry Matter	Crude Protein	Percent of C. P.		Amino N	Ammonia N
			True Protein	Non Protein Nitrogen		
(hours)	(%)	(%)	(%)	(%)	(%)	(%)
0	16.1	20.2	91.1	8.9	2.6	0.1
2.5	19.2	18.3	88.6	11.4	5.9	0.2
6.5	26.8	17.3	87.3	12.7	7.1	0.2
26.5	39.0	17.9	82.7	17.3	9.2	0.6
SILAGE	39.0	19.6	45.2	54.8	27.4	6.9

Thomas & Thomas. 1988. p.276 Recent Devlp. Rum. Nutr. 2

Protein Requirements of Livestock

Different classes of livestock will have very different needs for protein. This protein requirement is dictated by two main areas. First, the rumen microbes need a source of protein so that they can efficiently digest the forage and supplements that are fed to the animal. As well as supplying energy as a by-product of their digestion, the microbes also supply protein to the animal in the form of microbial cells. In the case of an animal that is not growing very fast or producing milk, these microbes will meet the protein needs. However, in the case of a fast growing calf or a lactating dairy cow, additional protein is needed. This protein must escape digestion in the rumen and be digested along with microbial cells in the small intestine. When animals have protein requirements in the ll% to 14% range, most if not all of the protein, can be supplied by microbes. Protein above that must be supplied from dietary protein that has escaped degradation in the rumen.

In using forage protein, one must first determine what protein is present in the forage. Following adequate sampling and analysis, the protein content of the various forages on the farm will be available. It is then a matter of matching the appropriate forage quality with the class of animal that needs it. It should be stressed that different operations require different qualities of feed. Young calves and lactating dairy cows require much higher quality forage than maintaining mature beef cows. Lactating beef cows require a better quality forage than a dry, pregnant cow.

Table 4: Minimum Crude Protein Needs of Livestock Classes

Class of Livestock	Crude Protein Requirements (%)
Pregnant Beef Cow	8
Lactating Beef Cow	11-14
Heifers	12-14
Lactating Dairy Cow	15-19

In beef operations it is important to realize that not all forage must be of extremely high quality. Some will definitely be needed to meet the needs of the young growing animals. For the remainder it is important to realize that maximum energy yield with sufficient protein to maintain microbial growth and energy supply is important.

In dairy operations optimum forage quality is more important. Low quality forage will result in reduced intake. Not enough concentrates can be fed to compensate for the poor forage quality. While dry cows do not need high quality forage there is usually enough problem with weather to ensure that there is an adequate supply of highly fibrous feed for this class.

In summary, there are a number of tools that can be used to control the protein level of your forage. It is important to know what the quality needs of your livestock are and aim to meet them. This means being able to identify the different qualities of forage and ensuring that the right class of livestock is receiving it.

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