

## **FORAGES FOR ALPACAS**

**From: Forage & Feeding Management for Alpacas,**

**By: Dr. David E. Anderson, DVM, MS and Daniel Linden**

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Let's talk about the complex carbohydrates – forages first! So what kind of hay should you feed to your alpaca? I can tell you idealistically, however, actual economics often plays a major role in determining exactly what an animal is being fed. I will provide you with the basic principles of what to use when evaluating forages like grass and alfalfa hays, but what you actually feed depends on where you live. Hays are not all the same as a multitude of factors affect the potential nutrient variability. Factors include the maturity of the forage when it is cut for hay, what was the weather when the hay was harvested, as well as losses due to harvesting and storage techniques. All producers know that if you want it to rain, cut down the hay!

In general there are two types of forages – legumes and grass. The most common legume fed in the United States is alfalfa, called lucerne in most other parts of the world. Clover, another legume is occasionally fed in the US, but predominantly in other countries. Nutritionally legumes are higher in protein and calcium than are grasses. There are in general three types of grasses: 1) cool season grass; 2) warm season grass; and 3) southern grasses. Examples of common cool season grasses include brome, timothy, and orchard grass. Cool season grasses do better in a temperate climate when it is cooler and there is ample moisture. Examples of warm season grasses are big and little bluestem, Indian grass and switchgrass. Warm season grasses do better when the temperature is higher and under drought-like conditions. Rotations of cool and warm season grasses are common to allow for seasonal changes. Southern grasses such as Bermuda grass are much lower quality than cool or warm seasons grasses - partially because they are grown in a much hotter climate. It is important for you to become familiar with the type of forages (and their idiosyncrasies) commonly fed/grown in your part of the country - before you feed alpacas!

Now let me discuss the simplistic components that make up a plant (Figure 1). A plant can be divided into cell solubles and cell walls. Cell solubles are starches, sugars – readily available carbohydrates that are digestible by all animals. Cell walls are the important part that we will use to determine forage quality. They are made up of lignin, cellulose and hemicellulose. For this discussion, let's say that lignin is not digestible by animal or microbial enzymes. Thus the more lignin in a forage, the more indigestible that it is, as the lignin ties up the rest of the plant components. The more mature forages are, the greater the lignin content. In general, the hotter the environment when a forage is grown, the higher the lignin content of that forage. Thus management (and luck) of the forage crop is critical when producing high quality forages.

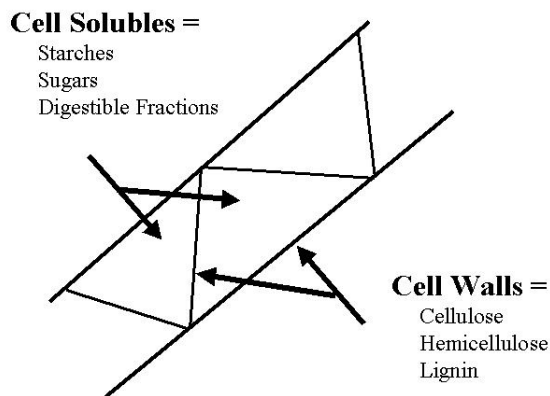


Figure 1. Schematic of Plant Components

In Compartment I of the alpaca GIT, the cellulose from forages is fermented by microbes. When the forage is more mature, there is more lignin and the cellulose fermenting capability of the microbes is diminished. The hemicellulose found in forages is very digestible by animals and microbes enzymes, but again if there are high amounts of lignin, the capability to digest hemicellulose will too be decreased.

Often alpaca producers do not produce their own forages, but purchase it from various sources. Thus, when purchased, a producer needs to sample that forage and have it analyzed. But what does that mean? What do you ask for when having forages analyzed and then how do you interpret the information that you get back from the laboratory? My recommendation is to ask for **proximate analyses** (includes CP and others), **fiber analyses** (to be defined shortly) and if possible the **calcium** and **phosphorus** levels. There are other measures that can be done, but at least this will provide enough information to determine forage quality.

Fiber analyses will be the focus of the next few paragraphs as these will help in determining the quality of your forage. Fibers are based on the principles of a scientist, Dr. Peter Van Soest, who developed the detergent fiber technique in the 1960's. Thus the techniques are also called the Van Soest fiber analyses. There are two of Dr. Van Soest's measures that we are going to use in this discussion and what you will need to ask for in the analyses request. They include: 1) acid detergent fiber (ADF); and 2) neutral detergent fiber (NDF). The ADF content of a plant includes lignin and cellulose concentration, while the content of NDF content of the plant includes the lignin, cellulose and hemicellulose concentrations. So what does an ADF or NDF level mean and how can you apply it to feeding the alpaca and determining quality of the forage being fed to your alpacas?

First lets look at the ADF concentration of the plant. The level of ADF can be used to determine how digestible forages are – digestible dry matter (DDM). If a feed is more digestible, then an animal can eat more and get greater energy and nutrient content from it, thus it is of higher quality. In Table 3, I have listed feeds of varying maturities with corresponding ADF and NDF values. In general, the more immature a forage when harvested, the higher the quality and the lower the ADF value. Likewise, the more mature

the forage, the lower the quality, and the higher the ADF value. The %NDF can be used to determine the dry matter intake (DMI) of forages (remember we have to remove all the water to calculate intake). Like the %ADF, %NDF can be used to determine forage quality. The higher the forage quality, the lower the %NDF and the higher the DMI. Conversely, the lower the forage quality is, the higher the %NDF and the lower the resulting DMI for the feed. An alpaca consumes less than a ruminant. On average a ruminant consumes 2 to 2.2% of its body weight in DM, while an alpaca at maintenance consumes on average 1.8 to 2.0% of body weight DM. Animals of differing physiological stages (growing, lactating, gestating) will eat more than an animal at maintenance. Animals at maintenance may consume more than 1.8 to 2.0% of their body weight, but then they are often prone to obesity. Listed below are the equations that can be used to calculate DDM and DMI, and thus assist in making a decision on forage quality.

### **Digestible Dry Matter (DDM) – for ruminants**

$$\% \text{ DDM} = 88.9 - (0.779 \times \% \text{ ADF}).$$

For example - if the %ADF = 31, then

$$\% \text{ DDM} = 88.9 - (0.779 \times 31) = 64.75\%$$

This means that the forage is 64.75% digestible. Compare this to the values given in Table 3. Note: In the equation, 88.9 and 0.779 are constants and cannot be changed.

### **Dry Matter Intake (DMI) – for ruminants**

$$\% \text{ DMI} = 120 / \% \text{ NDF}$$

For example – if the %NDF = 40, then

$$\% \text{ DMI} = 3\% \text{ of the animal's body weight}$$

A %DMI value of 3.0% means that the forage is high enough in energy that an animal could eat 3% of its body weight! That is very high, energy forage when you are looking for 1.8 to 2.0% for animal maintenance. This quality of forage would be excellent for females in late gestation and early lactation, assuming that the protein level is also adequate – and in the majority of cases, if the digestibility and resulting energy is higher, then so is the protein content. Note: In the equation, 120 is a constant and cannot be changed.

For maximum quality and quantity, alfalfa is harvested at what we call 1/10 bloom. That means that approximately 1/10 of all blossoms on a plant or plants in the field are in bloom and the rest have not yet blossomed out. This is called early bloom in reference texts. In general, the more blossoms open on a plant the greater the maturity. In Colorado, it is usually possible to have three harvests or cuttings of alfalfa. At higher altitudes this may be reduced to a single cutting (if alfalfa can be grown at all), while in other parts of the country, six or more cuttings can be harvested. Emphasizing Colorado management in this dialogue, the first cutting of alfalfa in the season is usually of lower quality than later

cuttings as it has larger stems, fewer leaves and more weeds. Later cuttings (second, third and fourth) have smaller stems and more leaves. Since the majority of the nutrients are in the leaves, the more leaves, the higher the quality of the forage. Later cuttings are usually of highest value and if managed correctly may bring a premium to the producer. The first cutting is usually classified as beef cow hay. The second and third cuttings of a forage is targeted by horse people. The third and fourth are considered dairy quality (if cut at an immature stage), as the highest quality forage is essential for maximum milk production. Therefore the later cuttings of a season are of higher quality in a perfect scenario. A perfect scenario is not realistic in most situations, as rainfall and other "situations" will affect the potential quality, even if you have harvested it at the perfect time.

**Table 3. Nutrient content<sup>1</sup> of forages commonly fed to alpaca (Dry Matter).**

**Forage %CP %ADF %NDF**

Alfalfa, pre-bud 23 28 38

Alfalfa, early bloom 20 30 40

Alfalfa, mid-bloom 17 35 46

Alfalfa, mature 15 41 53

Alfalfa-grass, midbloom 15 38 55

Alfalfa-grass, mature 12 42 52

Brome, late vegetative 14 35 63

Brome, late bloom 8 49 81

Orchardgrass, late vegetative 18 31 55

Orchardgrass, early bloom 15 34 61

Wheat straw 4 54 85

<sup>1</sup> Pioneer, 1995

Grass is normally harvested only twice in Colorado - thus, there are only two cuttings. At higher altitudes there will only be one cutting. When harvesting grass for hay, the more immature the grass is when cut, the higher the quality of forage. As the plant matures, seedheads develop and as they begin to emerge, the quality of the hay goes down. If all of the plants have seed heads, the hay is now called mature hay, and is of lower quality. Generally the first grass hay cutting of the season is of higher quality. As the season advances and temperatures increase, the amount of lignin in the plant increases, lowering the digestibility. Therefore, the earlier, more immature cuttings are of higher quality than later cuttings. Therefore, it is possible to break open a bale of hay and look for the number of blossoms and seedheads. The more blossoms and seedheads found, the more mature the hay and the lower the quality.

Once the forage has been harvested or purchased it needs to be stored correctly to protect nutrients in the feed. The best form of storage is to put the hay in an enclosed barn or shed. If that is not possible, a tarp can be draped over the stack of hay and secured. Either way serves to protect the forage from losing nutrients to bleaching from the sun or leaching of nutrients by rain or snow. After one year's storage there is a decline in the nutrient content, so it is best to appropriate that amount of forage that can be fed in one year's time.