

# Forage Analysis – What Does It Mean?

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Forage (pasture and hay) is the primary food of the horse and thus the quality of it is very important in maintaining his health. Do you know if your horse's forage meets his needs?

Forage analysis can tell you if your forage will provide adequate nutrition for your horse's needs, or whether he needs a supplement or grain mix to balance his diet. This is particularly important for horses that have health problems that can be affected by certain nutrients. Some of these conditions include hyperkalemic periodic paralysis (HYPP), exertional rhabdomyolysis (tying-up), laminitis and Cushing's disease.

The nutrient content in forages depends on plant variety, maturity, and environmental effects. Immature plants tend to be higher in protein and lower in fibre, whereas overly mature plants will contain more fibre and less protein. Soils in some regions are deficient in certain minerals, such as selenium, or may have excessive amounts.

## **On Farm Hay Sampling Procedures – Dry hay**

With increasing sophistication of feeding programs and the fine-tuning of formulations, it is important to collect a representative sample of what the horse(s) will be consuming. A previous study conducted by one of our lab personnel indicated that there are significant variations in analysis between samples, bales of hay and over time of sampling. The more representative the initial sample is, the more accurate the forage analysis results are. Recommendations for obtaining an accurate sample of your hay are indicated below and in the attached "SOP for Dry Hay and Baleage Sampling".

### Recommendation:

- Sample from a minimum of 10 bales. Use a core borer to take a core sample from the centre of each bale. If a core borer is unavailable, take a grab sample from the middle of 10 bales. Bag each sample separately.
- Ensure that the bale selection is random and specific for each cut.
- Indicate the type of hay (alfalfa, mixed, grass) and cut (first, second, third) for each sample.

Forage samples can be sent to your local Shur-Gain dealer, who will send it to Shur-Gain for analysis. Lab results of your forage samples should be completed within 2-3 business days. Understanding your results is important in determining the quality of your forage. There are two columns of data – "as fed" and "dry matter", which indicates

the nutrient levels before and after all the moisture is removed. The values in the “dry matter” column will be more concentrated and thus have a higher number than the values in the “as fed” column. When comparing more than one forage sample, look at the dry matter column, which puts all forages in the same category, because the “as fed” values are affected by the moisture content of the sample. The parameters analyzed in the forage sample includes moisture, ash, crude protein, fat, acid detergent fibre, minerals, digestible energy, potential digestibility and forage quality index.

**Moisture** – Moisture content is an indication of how well the forage was dried prior to storage. Hay should be baled when the moisture content is less than 20 percent. Due to their large size and high density, large round bales should have a moisture content of less than 16 percent. Most hays will dry to 10 to 15 percent.

**Ash** – Ash is influenced by the mineral content of the forage. Ash content increases with increasing levels of macro minerals. Ash levels above 12% could indicate the forage sample was contaminated with soil.

**Crude Protein (CP)** – This is a measure of the protein concentration of the hay. Crude protein content decreases with advancing maturity of the forage. Maturity parameters are measured by the ADF levels. As ADF increases, CP usually decreases. CP is also influenced by the amount of grass in the forage mixture and the maturity of the grass. In alfalfa, the leaves contain the highest protein component of the entire plant. As the alfalfa plant matures, the leaf to stalk ration decreases, which results in decreased protein content. See Table 2 for typical protein ranges and table 2 for the 2007 Shur-Gain Laboratory hay analysis results.

**Fat** – Forage fat levels tend to be low, with a range of 2 -3%.

**Crude Fibre** – Forages vary widely in fibre content. Crude Fibre is the best estimate of how digestible the forage is. Grasses and legumes harvested at their prime will be lower in fibre and highly digestible. Overly mature hay will have higher fibre content and thus will be less digestible.

**Acid Detergent Fibre (ADF)** – ADF is the measure of the less digestible fibre content of the forage. This includes the cell wall portions of the forage that are composed of cellulose and lignin. An ADF level of 30 - 34% indicates the forage is in the pre-bloom stage. The mid-bloom stage should have an ADF range of 35 – 39%. ADF levels over 40% indicate the forage is in the late bloom stage. ADF is a good indicator of digestibility across different species of grasses and legumes. As ADF increases, digestibility and nutrient availability decreases.

**Minerals** – Forage tests will include the major (macro) minerals (calcium, phosphorus, magnesium, potassium, sodium) and some trace (micro) minerals (zinc, copper, manganese). The mineral content of forages varies, depending primarily on plant maturity and species present in the forage. Fertilizing grasses and legumes may change the mineral levels in the forage.

**Digestible Energy (DE)** – This is the measure of the digestible energy in the forage for a horse. It is calculated using a mathematical equation that uses CP, ash, fat and ADF levels.

**Potential Digestibility (PD)** – Potential Digestibility is the measure of carbohydrate availability. Increasing PD values indicate higher digestibility. PD values less than 70% indicated low quality, 70-80% PD indicated good quality and PD values more than 80% indicate excellent quality.

**Forage Quality Index (FQI)** – FQI is a measure of the relationship between fibre and PD. Typically, as fibre increases, PD and FQI will decrease. The forage quality index determines the value of the forage and is a useful comparison between forages.

**Table 1.** Shur-Gain forage analysis ranges.

Parameter	Unit	Alfalfa	Mixed	Grass
Ash	%	7 - 12%	7 - 11%	5 - 8%
Crude Protein (CP)	%	14 - 26%	12 - 20%	12 - 22%
Fat	%	2 - 3%	2 - 3%	2 - 3%
Acid Detergent Fibre (ADF)	%	25 - 50%	25 - 50%	25 - 50%
Sodium (Na)	%	0 - 0.17%	0 - 0.12%	0 - 0.06%
Calcium (Ca)	%	1.0 - 2.5%	0.8 - 1.8%	0.3 - 0.8%
Phosphorus (P)	%	0.2 - 0.4%	0.2 - 0.4%	0.2 - 0.4%
Magnesium (Mg)	%	0.15 - 0.35%	0.15 - 0.35%	0.15 - 0.35%
Potassium (K)	%	0.8 - 4.0%	0.8 - 3.6%	0.6 - 3.0%
Copper (Cu) *2005 Forage Averages*	%	8.01	5.38	5.21
Manganese (Mn) *2005 Forage Averages*	%	43.90	34.26	40.61
Zinc Zn *2005 Forage Averages*	ppm	22.91	21.12	20.77
Digestible Energy (DE)	MJ/kg	6.4 - 8.3	5.9 - 9.1	5.7 - 9.4
Forage Quality Index (FQI)	-	83 - 144	73 - 113	70 - 104
Potential Digestibility (PD)	%	55 - 85%	55 - 85%	55 - 85%

**Table 2.** 2007 Shur-Gain averages and ranges of analyzed hay samples.

Forage Type	DM %	CP %	ADF %	Ca %	P %	Mg %	K %	DE MJ/kg	FQI	PD %
<b>Alfalfa Hay</b>										
Minimum	66.86	5.12	36.50	0.34	0.11	0.12	0.69	5.84	84.44	51.03
<b>Mean</b>	<b>84.08</b>	<b>19.15</b>	<b>36.50</b>	<b>1.43</b>	<b>0.28</b>	<b>0.28</b>	<b>2.18</b>	<b>7.59</b>	<b>123.91</b>	<b>74.57</b>
Maximum	89.99	27.80	58.75	2.78	0.44	0.61	4.08	8.98	170.80	90.45
<b>Mixed Hay</b>										
Minimum	64.12	9.80	26.11	0.21	0.11	0.11	0.85	6.26	91.18	57.89
<b>Mean</b>	<b>84.42</b>	<b>15.43</b>	<b>39.62</b>	<b>1.03</b>	<b>0.25</b>	<b>0.23</b>	<b>2.09</b>	<b>7.65</b>	<b>112.37</b>	<b>70.24</b>
Maximum	89.65	22.75	49.91	1.96	0.49	0.53	3.54	9.37	133.03	80.41
<b>Grass Hay</b>										
Minimum	55.18	5.09	24.09	0.19	0.06	0.08	0.64	5.84	73.57	45.80
<b>Mean</b>	<b>84.68</b>	<b>11.96</b>	<b>43.02</b>	<b>0.67</b>	<b>0.21</b>	<b>0.20</b>	<b>1.85</b>	<b>7.33</b>	<b>98.17</b>	<b>63.26</b>
Maximum	90.67	20.49	60.64	1.59	0.45	0.40	3.80	9.27	124.65	76.03

Most horse owners know the importance of feeding good forage, but they often don't take them into consideration when feeding their horses. Forage analyses will assist you in feeding your horse more effectively and efficiently.

## References

Doupe, Anna. 2005. Forage Farm Sampling Project. *In Handy Tips: A Publication for Dairy Business Developers*. Shur-Gain Inc.

Woodley, Bill. 2006. Shur-Gain Forage Analysis Interpretation. Shur-Gain Inc.