



Identify Your Hay's Digestibility, then Description

Hay can be Described as: "Premium, Good, Utility or Poor"
What do Each of Them Mean and How to Use Them
Select the Best Hay to Complement Your Horses Needs* (Table 4)

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Getting that load of fresh, sweet-smelling hay into your barn for the year can be a very rewarding time for many of us as horse owners. It can also be a time of frustration because we cannot always get the hay we want or need. Horse Hay is graded as: Premium, Good, Utility and Poor. (Utility means: "Something Useful") When it comes to hay quality, there is no "one grade fits all".

We all would like to get the best hay to complement our horses needs, however, weather, baling delays, cost and variable sources to purchase hay, can be frustrating. This article will look at the different: Descriptions, Grades and the Relative Feed Value of hay, then: how to feed them to specific types of horses in the way to best complement their nutrient needs. (Table 1)

Table 1: Description of Hays

PREMIUM: Early Maturity when harvested, pre-bloom, extra leafy and fine stemmed. All indicative of High Nutrient content and free of damage.

GOOD: Early to average Maturity, early to mid-bloom, leafy, fine to medium stemmed, free of damage.

UTILITY: More Mature, mid to late-bloom, below average leaf to stem ratio, course, thicker stemmed.

POOR: Very Mature, dried blossoms or long seed heads, very coarse stemmed. Also includes hay with: excessive damage, heavy weed content, mold or any dead animals.

Upon 'visual inspection', the **PREMIUM Hay** will be cut in the 'pre-bud' stage. So, the legume 'buds' will be beginning to form, and the cool season grasses will have seed heads less than one inch long and the stems will be very small in diameter. The **GOOD Hay** will have legume buds showing and the grass seed heads will be less than three inches long, while the stems will be thicker, but not stemmy. The **UTILITY Hay** will contain mature, dried blossoms in legume's and grass seed heads less than six inches long, while the stems will be more thick and coarse. The **POOR Hay** will contain mature, dried legume blossoms, and the grass seed heads will be over six inches long, while the stems will be very coarse and contain more stems and less leaves.

Hay can also receive a 'Grade', based on a 1-5 scale, according to its nutrient analysis and the maturity of its fibers, ADF and NDF. (Table 2) Although considered the highest grade, **PREMIUM Hay** (Grade 1) may not be ideally suited for your horse and may not be affordable or attainable. Hay of Grades 3 and 4, also called **UTILITY Hay**, may be ideal for your horse, based on their nutrient needs. First, we must identify your horses: a) 'activity level', b) 'reproductive status', or c) 'growing', i.e. age, to help determine their nutrient needs. Then learn what 'DESCRIPTION',

'GRADE' or 'RELATIVE FEED VALUE' of hay is optimal for them to eat, and which is the most cost effective and optimal for their health, i.e. body weight and gut function.

The Hay 'Analysis' from a forage laboratory, will provide its maturity when it was cut. The following changes will occur as the hay matures and gets taller in the field: a) Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) will increase, as the b) Starch and Sugar (NSC), c) Crude Protein, d) Calories (Digestible Energy in Mcalories) and e) all the Mineral percentages and parts per million will decrease. Tables 2 and 3 show how much the ADF and NDF will increase as the forage matures and ages in the fields (not in the hay mow). It is a combination of the ADF and NDF that will provide the calculated RELATIVE FEED VALUE (RFV) for all forages.

- Forage laboratories can provide you with the '**Relative Feed Value**' (RFV) in their report.
- Horse owners and Hay brokers use a '**Description**' to identify the quality of their hay.
- The American Forage and Grassland Council uses a '**Grade**' scale to determine quality.

Therefore, we need to be able to correctly interpret these THREE interchangeable names or titles, to assure we are talking the same quality and avoid confusion. (Table 3)

Always use the 'Dry Matter' analysis column when evaluating your forage reports. This will remove the variable water content and provide a consistent nutrient analysis, for you to use when selecting what nutrients need to be in your 'Horse Feed or Balancer' to complement your forage (hay and pasture) and meet all of your horses nutrient needs.

Too many times the horse owner or broker of hay, state their hay is '**GOOD**' hay, but when analyzed, it has a RFV between 75 and 102, making it a '**UTILITY**' Hay, that is not worth as much money per ton or bale, from a nutrient point of view. OK, that leads us to discuss economics. Hence, the necessity of learning the **Description, Grade and RFV** of all hays and how they are related. Economics of horse management AND the health of your horse can depend on it.

Table 2: The "Plant Carbohydrates" are reported in percentages found inside the plant. As the plant matures, the "Cell Walls" will increase its fiber percentages (Hemicellulose and Cellulose), while the "Cell Contents" will decrease accordingly (Sugars, Fructans and Starch). Remember, the percentages of the plant cannot go over 100%. Therefore, the higher the ADF and NDF, i.e. the fermentable fibers, the lower the ESC, WSC and Starch, i.e. types of calories.

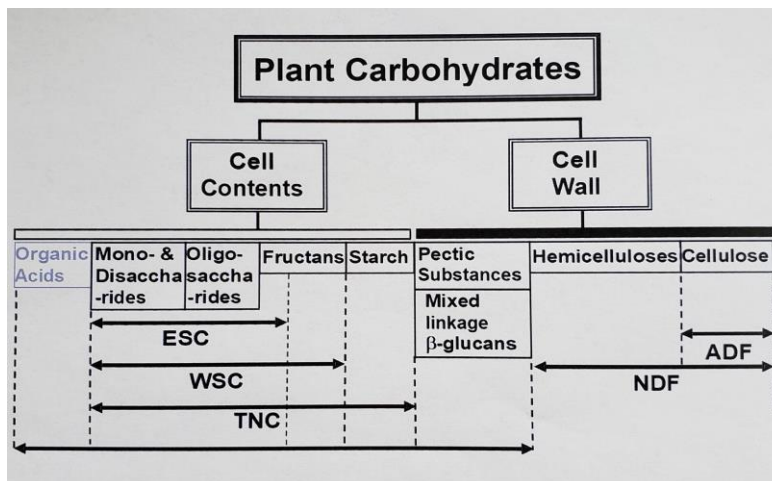


Table 3: Using Forage Description, Grade and Relative Feed Value (RFV), with corresponding ADF and NDF, as a Management Tool to Evaluate and Determine your Hays 'True Value' and which is best for your horses.

<u>Description</u>	=	<u>Grade</u>	=	<u>RFV Ranges</u>	(	<u>ADF%</u>	)	<u>NDF%</u>
PREMIUM		1		>125	(	<35	)	<46
GOOD		2		124 – 103	(	36 – 40	)	47 – 53
UTILITY		3 & 4		75 – 102	(	41 – 45	)	54 – 65
POOR		5		< 74	(	>46	)	>66

*** Table 4: Using Forage Description to Help Understand which is Best your Horses**

<u>Description</u>	<u>Best to Meet the Nutrient Needs</u>	<u>Forage Grade</u>	<u>Best RFV to Feed</u>
Premium	Best for: Upper Level Performance, Lactating, Sucklings, Weanlings - For the Highest Need	1	Over 125
Good	Best for: Lower Level Performance, Yearlings - For the Medium Need	2	103 to 124
Utility	Best for: Mature: Idle, Lay-ups, 'easy-keepers', lay-ups, Idle-Mature Horses, and Special Needs, i.e. EMS, IR, Cushings, Laminitis, PSSM, etc. - For the Lowest Need	3 & 4	75 to 102
Poor	Because there is a high incidence of 'impaction colic' due to the amount of 'over mature and indigestible' fiber - Avoid Feeding	5	Below 74

Glossary:

Most of the following definitions are from Richard Ten Eyck is the Oregon Department of Agriculture Feed Specialist and chair of the Carbohydrate Working Group of the Feed Labeling Committee for the Association of Animal Feed Control Officials (AAFCO).

- 1) **All Forages (grasses and legumes): Fed as:** Hay (dried), Haylage (fermentation), or Pasture (fresh).
- 2) **'Cool Season' grasses:** Timothy, Bluegrass, Orchardgrass, Fescue, Brome, Prairie Hay, etc.
- 3) **'Warm Season' grasses:** Bahia, Tiftin-44, Coastal Bermuda, etc.
- 4) **Legumes:** Alfalfa, Clover, Lespedeza, Peanut Hay, etc.
- 5) **SC (Structured Carbohydrates):** are the 'fibrous portions' of the plants cell walls. The different 'types' of fiber will be listed as ADF and NDF, in percent. The A.D.F. determines forage 'digestibility' or 'how palatable it is' and if a horse will eat it. The N.D.F. determines forage 'intake', or 'how much a horse can eat per day'.
- 6) **NSC (Non-Structured Carbohydrates):** Currently listed as: Starch + Sugar for all forages and grains. When laboratories become uniform the forage analysis will differentiate between the 'types' of sugars and be listed as: Starch + WSC, and Starch + ESC. The cereal grains can be listed as 'Starch + Sugar' **or** 'Starch + ESC'.

- 7) **Cereal Grains:** Oat, Corn, Wheat, Barley, Rice, etc. (Contains no Fructans)
- 8) **Protein Grains:** Soybean, Cottonseed, Distillers Grains, Linseed, etc.
- 9) **'Horse Hay' names for horse owners to learn and purchase accordingly, based on fiber fermentability and available calories/nutrients per pound.**

Description = Grade = RFV Ranges

Premium1 > 125

Good 2 103 to 124

Utility 3 & 4 ... 75 to 102

Reject 5 < 74

If you are provided the RFV from the forage lab, you can use the right portion of this chart and move left to find its Grade and accurate Description.

Example: Sampling & Cost from two Forage Laboratories:

[Equi-Analytical | Profiling Feed for Better Nutrition \(equi-analytical.com\)](http://equi-analytical.com). Open to read their: analytical services, how to take a sample, how to submit a sample and receive their results.

- 1. **For Mature Horses:** Code 600 = Fast Track - \$18.00;
- 2. **For Growing and Reproducing Horses:** Code 601 = Equi-Tech- \$28.00;
- 3. **When Nutrition Problem Solving:** Code 604 = Equine Complete - \$97.00.

Holmes Laboratory - <https://holmeslab.com/http://holmeslab-com/wp-content/uploads/2016/03/feed-information-sheet-pdf/forage-feedstuff-testing/>

- 1) **For Growing and Reproducing Horses:** Test AG = \$50.00
- 2) **When Nutrition Problem Solving and for Upper Level Performance Horses:** Test 5 = \$89.00

Forage Recommendations for Horses Based on its 'Structured' and 'Non-Structured' Carbohydrates

I.) Structured Carbohydrates (SC) in Forages

The Hay Marketing Task Force of the American Forage and Grassland Council has endorsed the use of **RELATIVE FEED VALUE (RFV)** as a measure of forage quality and its fiber digestibility/fermentability:

What is forage RFV? All forage laboratories can provide you with a RFV number for each forage analyzed. There is a direct relationship of the RFV, to the digestibility and fermentability of the forage. The higher the number, the higher the fiber digestibility and the availability of the nutrients found inside the plant cells, and vice-versa. These fibers are 'broken down by microbes' in the large intestine of the horses and absorbed.

- **ADF (Acid Detergent Fiber)** The less digestible carbohydrates (fibers) are found with-in the plant cell walls, and include: Cellulose and Lignin.
 - a. The lower the ADF, the more palatable the forage and its the digestibility, and visa-versa.
- **NDF (Neutral Detergent Fiber)** The total plant cell wall carbohydrates, includes the: ADF plus Hemi-cellulose. Often considered an indicator of forage quality and intake potential per day.
 - a. The lower the NDF, the easier it is to digest and the greater the potential intake/day, and vise-versa. Also, the softer the hay when squeezed, is the best indicator of plant maturity and the easier it is to digest.

Table 1: Lists the different quality standards for horses: Forage Grade and Description, along with their corresponding percentages of ADF & NDF and their resulting Relative Feed Values (RFV)

<u>Forage Grade</u>	<u>(Description)</u>	<u>If the ADF is:</u>	<u>If the NDF: =</u>	<u>Then the RFV is:</u>
Prime	(Excellent)	Under 30	Under 40	Over 151
1	(Premium)	31-35	41-46	150-125
2	(Good)	36-40	47-53	124-103
3	(Utility)	41-42	54-60	102- 87
4		43-45	61-65	86- 75
5	(Reject)	Over 46	Over 66	Under 74

This table is from the veterinary textbook, *Equine Internal Medicine*, 2nd Edition, 'Applied Nutrition' Chapter, Donald R Kapper, PAS, guest author and Stephen M Reed, DVM, editor.

'Good Quality' has a Forage Grade of 2, or has a RFV between 124 & 103. If the **RFV is below 102**, additional nutrients may need to be fed per day, due to the lower nutrient percentages and availability in that forage. If the **NDF is over 66** or the **RFV is below 74**, we do not recommend feeding, due to the increased risk of impaction colic.

2.) Non-Structured Carbohydrates (NSC) in Forages

All horse owners/managers/trainers need to understand the different carbohydrate components and how to optimally utilize them, when setting up their feeding programs. Why? Because all carbohydrates are not created equal!

NSC (Non-Structural Carbohydrates): use to be describe as easily digestible carbohydrate components of feed ingredients. Originally explained as: starch + sugar + fructans, but recently divided into: ESC + starch and WSC + starch. They are 'broken down by enzymes' in the foregut of the horse and absorbed. Therefore, it is important to switch forages slower than grain mixtures.

- A.) ESC (Ethanol-Soluble Carbohydrates):** are carbohydrates that dissolve in ethanol solution; these carbohydrates are primarily digested in the small intestine. High ESC generally means this feed will generate a high glycemic (blood sugar) response. Beneficial to hard-working horses that need more 'short term' energy, but not for horses that are sensitive to blood sugar changes (i.e. insulin-resistant horses, etc.).

- B.) WSC (Water-Soluble Carbohydrates):** are soluble carbohydrates that can be extracted with water, including: simple sugars and fructans (large sugars). High WSC might indicate high fructan levels in ‘cool season’ grasses, or high simple sugars in ‘warm season’ grasses and ‘legumes’. This could be beneficial to horses needing extra endurance, but not for horses with, or predisposed to, laminitis.
- C.) Fructans:** are carbohydrates made up of many large molecules (complex sugars); and are only digested by fermentation, in the hind gut. They are found in ‘cool season’ grasses (Ky Bluegrass, Timothy, Orchardgrass, etc), and are not found in Legumes (Alfalfa, Clover, Peanut Hays, etc.), or in ‘Warm Season’ Grasses (Coastal Bermuda, Tifton, etc.)
- D.) Starch:** Large amounts are found in cereal grains (oats, corn, barley, rice, wheat, etc.) and are digested by enzymes in the small intestine, where they are broken down and absorbed as glucose (simple sugar). **Low starch content means** a small amount of glucose will be absorbed in the small intestine (low glycemic response). This is good for horses that can't handle large blood sugar changes (i.e., insulin-resistant horses). **High starch content means** a potential high glycemic response. Good for horses needing ‘quick’ energy (fuel for fast twitch muscles). **This is beneficial to all horses whose heart beat exceeds 170 bpm while training or competing.**

RECOMMEND: Feed Forage plus a Balancer, for horses with Insulin Resistance, Cushings, Equine Metabolic Syndrome, PSSM, or Laminitis, to keep the nonstructural carbohydrates below 15% in the total diet. Severely affected **Insulin Resistant (IR)** horses need to be kept **below 10% ESC + starch** in the total diet, while all **Laminitic, or horses prone to Laminitis**, should be kept **below 12% WSC + starch**. If the hay NSC's are unknown or higher than recommended, ‘soak’ it in ‘cold’ water for 20 minutes, then let it drain for 10 minutes before feeding. This will remove about 30% of the nonstructural carbohydrates. Discard the water.

NOTE: Because all cereal grains and molasses are high (45% to 75%) in NSC or ESC + Starch, we do not recommend feeding any horse feed that contains cereal grains or molasses in its ingredient list to horses diagnosed with: IR, Laminitic, PSSM, Cushings or Equine Metabolic Syndrome. If extra calories are needed, use vegetable oil and a fermentable fiber as their calorie sources, not cereal grain or molasses. The three ‘best’ sources of fermentable fibers are: beet pulp, soybean hulls and alfalfa.

BE AWARE – All Fibers are NOT created equal!!

There are ‘indigestible’ sources of fiber available today that are very inexpensive and are being used in feeds to keep the price per bag down. They include: Oats Hulls (Oat mill feed), Rice Hulls and Peanut Hulls. They all contain a high percentage of lignin, which is not digestible by the horse. Read the ingredient lists to see if they are in it. They can also be called ‘Plant By-Products’ or ‘Processed Grain By-Products’, if ‘group terminology’ is used in the ingredient list.

How Much to Feed Horses per Day?

- 1) **Hay:** Every mature horse with a BCS <6, should be fed a minimum of 2% of their body weight per day in hay. That would equal 20 lbs. of hay per 1,000 lbs of body weight.
- 2) The amount of protein, minerals and vitamins needed per day will depend on the individual horses’ size, and: a) age, b) reproductive status, or c) training level. These nutrients are included in all ‘Balancers’ and ‘Horse Feeds’. To help you determine how much to feed per day, read the ‘Feeding Directions’ found on each bag. The ‘minimum’ amounts to be fed per day are listed there, according to their individual body weight.
- 3) The number of calories that need to be fed per day to maintain desired body weight, will depend on each horses: a) metabolic rate (metabolism), b) the calories per pound (the digestibility/fermentability, i.e. RFV) in their forage (hay and pasture), c) their exercise level per day, and d) their current Body Condition Score (BCS). Extra calories can be added, when needed, with: a) ‘vegetable oil’, or b) Oats, Beet Pulp or Hay Cubes, when feeding Balancers, or c) a Premium line of feed, formulated to meet your horses’ physiological needs, i.e. be sure to follow their Feeding Directions listed on each bag/tag.

The following chart is a management tool for you to use and compare your forage print-out, on a dry matter basis

If the nutrients on your hay analysis report are with-in the following “ranges” under each classification of forage, i.e. Grass, Mixed, or Legume, then proceed by feeding the recommended amounts, listed as the minimum pounds per day, found on the ‘Feeding Directions’ of each Horse Feed or Balancer.

If the ‘forage’ RFV is lower than 102, or your hay ‘analysis’ is outside of any of the following ranges, we will need to ‘adjust’ the number of pounds fed per day to compliment your forage.

The Following Nutrient Ranges are Based on:

- 1) Your ‘Type’ of Hay, and
- 2) when the Relative Feed Value (RFV) is Between 103 & 150 (Grades 1 & 2)

RFV is an Indicator the Digestibility/Fermentability of your Hay

Nutrients	Grass Forage Analysis	Mixed Forage Analysis	Legume (Alfalfa) Forage Analysis
Dry Matter	87.0 - 92.0 %	87.0 - 92.0 %	87.0 - 92.0 %
Crude Protein	9.0 - 15.0 %	12.0 - 18.0 %	18.0 - 24.0 %
Lysine	.30 - .51 %	.51 - .76 %	.91 - 1.22 %
Crude Fat	2.0 - 2.4 %	2.3 - 2.7 %	2.6 - 3.0 %
ADF	40.0 - 31.0 %	40.0 - 31.0 %	40.0 - 31.0 %
NDF	60.0 - 45.0 %	56.0 - 43.0 %	53.0 - 41.0 %
DE Mcal/lb	.86 - .95	.93 - 1.10	1.00 - 1.17
Calcium	0.25-0.80 %	0.80-1.20 %	1.20-1.80 %
Phosphorus	0.20-0.30 %	0.25-0.35 %	0.25-0.35 %
Potassium	0.80-1.50 %	1.50-3.00 %	2.00-3.50 %
Magnesium	0.15-0.25 %	0.20-0.30 %	0.20-0.35 %
Sulfur	0.15-0.30 %	0.20-0.35 %	0.25-0.35 %
Manganese	40-70 ppm	40-60 ppm	40-50 ppm
Iron	60-200 ppm	60-200 ppm	60-200 ppm
Copper	2-10 ppm	4-10 ppm	4-10 ppm
Zinc	12-26 ppm	14-26 ppm	14-28 ppm

Relative Feed Value (RFV) is the best way of determining the digestibility, or availability, of the nutrients within the plant. Forages with RFV’s greater than 103 are of good quality and those below 102 are of lower quality. If your forage RFV is under 102, we would expect the nutrient analysis to be lower than those listed on the above chart and the amount of your ‘Feed or Balancer’ may need to be adjusted accordingly.

- I. The nutrient ‘amounts’ within the plants are affected by:
 - 1) ‘type’ of forage, (grass vs. legume)
 - 2) maturity at harvest, (how course are the stems)
 - 3) soil type the hay was grown on
 - 4) nutrients available in the soil and the amount of fertilizer applied
 - 5) amount of rainfall during the growing season
 - 6) ambient temperature during the growing season
- II. The nutrient ‘availability’ is affected by the RFV of the plant when harvested.

Providing the Mare's 'Recommended Allowance' (RA) while Open, Pregnant and Lactating, on a Total Ration Dry Matter Basis (includes the average of each nutrient from the: 1) forage and 2) horse feed fed per day)

Nutrient	Open	Pregnant	Lactation (1-3 Months)	Lactation (4-6 Months)
Dry Matter intake, % body wt*	1.5-2.0	1.5-2.0	2.5-3.5	2.0-3.0
Crude Protein, %	8.50	11.50	15.00	13.00
Calcium, %	.30	.53	.70	.50
Phosphorus, %	.21	.35	.40	.34
Potassium, %	.40	.50	.80	.60
Magnesium, %	.10	.12	.15	.12
Sodium, %**	.14	.14	.20	.16
Copper, mg/kg	15	25	25	25
Iron, mg/kg	40	80	80	80
Manganese, mg/kg	40	60	60	60
Zinc, mg/kg	40	70	70	70
Cobalt, mg/kg	.20	.20	.30	.25
Iodine, mg/kg	.25	.25	.50	.35
Selenium, mg/kg	.15	.20	.30	.20
Vitamin A, IU/kg	2,000	3,000	3,000	3,000
Vitamin E, IU/kg	50	80	80	80
Thiamine, mg/kg	3	3	3	3
Riboflavin, mg/kg	2	2	2	2

This chart is from the Veterinary Textbook: *Equine Internal Medicine*, 2nd Edition, 'Applied Nutrition' Chapter, Sanders & Co., published 2004.

Originally published by The Ohio State University, Department of Veterinary Sciences, after their 4 year study on 'Metabolic Bone Disease', 1986.

- * Feed intake is determined by: Body capacity, RFV of forage, physiological status, activity level and environment.
- ** Average conditions: 0.35% to 0.50% Salt (NaCl) is recommended in the total diet.
- Needed Digestible Energy, Mcal/Day, is determined by: Body size, metabolic rate, reproductive status, dry matter consumption per day and Body Condition Score.

Compare the analysis of your hay to the appropriate column of recommended nutrient allowances of your mares' reproductive status, listed above. You will then know which nutrients will need to be added to meet your mares needs.

IF you are using a computer program to balance your horses diets, use the above 'Recommended Allowance' numbers instead of the NRC 'minimums'. IF you need assistance, call the nutritionist of the Feed Company you are working with, or your local County Agricultural Extension Agent.

Remember, the above numbers are the 'averages' of the amounts fed per day between your hay and the Horse Feed and/or Balancer/Supplement your mares are eating per day.