

Is Old Hay Better for Horses with Laminitis?

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As I travel around the world, learning and teaching people about feeding horses with laminitis, I keep hearing a recommendation that has never made sense. People say that leaving hay in a shed for a year renders it 'safe' for horses with laminitis. You will commonly hear cattle producers say that the nutrient content of hay changes after 'going through the sweating period'. This is true in a certain context, but the changes that occur happen in the first month, and only apply to hay baled above 20% moisture. (Coblentz, 1996) In many humid regions it is common to put up cow hay wetter, realizing it may heat up, and mold slightly; but some mold on hay is generally safe for cows. Many horse people who hear this advice assume that hay must stay in the stack at least a month before a hay sample can be pulled for analysis. This is not true in most cases for horse hay, which should be baled when it is between 12-15% moisture to prevent formation of mold. It is true that hay loses vitamins A and E after a year in storage. Perhaps this can be construed as 'loss of nutrients' if using very general terms, but depletion of vitamins will not prevent laminitis or obesity, which is caused by excess sugar and calories.

Forage researchers have shown that when hay moisture is below about 40%, the enzymes that control respiration stop, so sugar can't be lost through respiratory mechanisms. If hay is kept dry, sugar can't leach out. Yeast, mold, and bacteria would eat sugar in hay baled above 18% moisture, but mold would also be present; since horses should not eat moldy hay, so baling wet is not a viable solution. There is no mechanism which explains how sugar, or any other nutrients that are routinely tested in forage, would just disappear in properly harvested and stored hay.

While searching for the source of this myth, it was brought to my attention that in a 1966 edition of the Pony Club manual, a recommendation is given to feed ponies 'old seed hay, preferably 12 to 18 months in the stack'. Also: 'Good old hay provides excellent keep for small stabled ponies'. While I value Pony Club advice for many things, it might be best to get advice for feeding laminitic ponies elsewhere. All this conflicting information needs to be put in the proper context of buying hay for horses that must have sugar and calories reduced.

Procedure:

A study was conducted in southern Colorado, where low humidity (20-30% RH) is common. Three lots of hay were selected; one 100% Italian ryegrass, one approx 75% alfalfa/ 25% brome/orchard grass mix, and one 100% alfalfa. Alfalfa bales were purposely selected from an area of the field that were shaded in the afternoon and had higher moisture. All were tested immediately after baling with a moisture probe, and 6 bales of each lot were placed in a hay shed on a pallet. A Penn State forage sampler was used to obtain one core per bale on the day of baling, and at 2 weeks, 2 months, 6 months, and 9 months. An additional sample of the alfalfa/grass mix was taken at 13 months. The 6 cores were well mixed in a clean plastic bucket, and were sent to the lab with no sub-sampling. Cores were made in a different quadrant of the bale at each sampling to minimize any possible affect of additional air contact.

Results:

The Italian ryegrass averaged 8 % moisture, the alfalfa/grass mix was 12 %, and the pure alfalfa was 20% moisture immediately after baling. The % moisture on the alfalfa baled at high moisture decreased rapidly due to dry storage conditions and air flow around the bales. No mold was noticeably by sight or smell and the color remained bright in all samples throughout the year of the study.

The variation in test results on a dry matter basis for Crude Protein, ADF, NDF, NFC, starch, Water Soluble Carbs, Ethanol Soluble Carbs, Ca, P, Mg, K, Na, Fe, Zn, Cu, Mn, Mo, and Digestible Energy where not greater than would be expected from testing error as per Dairy One Forage Testing Lab manager. You may be surprised, as I was, at the very large variation in some minerals results. This is because testing for some minerals, such as iron, is not as exact as we would like it to be. Some test results on some sampling dates were slight higher than previous, and some were slightly lower than previous. Since it is impossible for nutrient concentration on a dry matter basis to increase in baled hay, we must also assume the slight reduction in results were from inherent sampling and testing error.

Hay storage nutrient content over time (dm basis) analysis by Dairy One																			
	% moist	CP	ADF	NDF	NFC	starch	WSC	ESC	% Ca	% P	%Mg	%K	% Na	Fe	Zn	Cu	Mn	MO	Horse DE
Italian Ryegrass																			
0 day	8.3	13.2	33.8	50.9	27.8	1.4	17.3	11.1	0.78	0.3	0.23	1.96	0.202	397	34	9	96	0.8	1.00
2 weeks	8.3	12.7	31.7	50.6	28.4	1.6	18.0	12.1	0.73	0.26	0.21	1.84	0.182	485	27	7	89	0.7	1.03
2 months	8.2	13.5	32.0	52.1	26.5	2.1	16.2	12.0	0.64	0.26	0.19	1.78	0.177	343	28	6	80	0.7	1.04
6 months	7.7	13.0	29.4	48.3	31.9	0.5	20.3	13.4	0.75	0.29	0.21	1.83	0.188	261	26	6	88	0.8	1.08
9 months	8.0	12.4	33.2	53.2	26.3	1.0	15.6	12.9	0.74	0.27	0.20	1.83	0.187	388	29	6	84	0.4	1.00
Alfalfa/grass																			
0 day	7.9	11.4	36.6	56.4	25.3	2.1	11.5	10.2	0.73	0.28	0.14	1.81	0.025	215	21	6	87	0.9	0.94
2 weeks	8.5	11	33.3	53.3	29.0	2.4	12.4	8.1	0.69	0.26	0.13	1.71	0.035	179	23	5	83	0.4	0.98
2 months	7.9	11.2	34.7	55.2	25.5	3.0	10.7	8.2	0.66	0.25	0.13	1.68	0.02	133	20	5	78	0.6	0.96
6 months	8.1	10.7	33.0	52.7	28.0	2.3	16.1	10.5	0.84	0.27	0.16	1.63	0.032	152	28	8	91	0.6	0.98
9 months	7.5	10.6	36.7	56.6	24.7	2.2	12.1	10.9	0.74	0.24	0.13	1.49	0.042	147	19	5	84	0.3	0.92
13 months	8.1	9.9	36.0	58.8	25.0	1.6	13.7	7.5	0.74	0.24	0.13	1.56	0.024	156	18	4	81	0.2	0.92
Alfalfa																			
0 day	8.8	24.9	26.8	35.7	31.9	1.2	9.8	7.9	1.44	0.26	0.18	2.29	0.039	209	21	9	27	0.8	1.31
2 weeks	11.5	26.1	23.6	31.7	34.6	0.8	8.6	3.7	1.62	0.24	0.19	2.02	0.035	324	21	8	30	0.8	1.41
2 months	9.8	24.6	25.8	34.7	33.0	0.9	9.8	8.5	1.59	0.26	0.18	2.3	0.036	211	26	8	31	0.9	1.33
6 months	9.4	25.3	26.2	32.1	34.7	0.8	9.7	11.3	1.53	0.25	0.18	2.29	0.036	200	21	8	26	0.5	1.33
9 months	8.8	25.2	26.8	35.2	32.1	0.4	8.3	4.2	1.57	0.27	0.19	2.31	0.037	223	22	8	28	0.8	1.32

Discussion:

Much of the knowledge and advice given regarding hay may apply to cow hay, but may not apply to horse hay. Previous work showing nutrient loss in stored hay shows that dry matter loss is closely related to initial moisture content of hay at baling. (Buckmaster) Hay baled at over 20% moisture can undergo chemical changes generating heat which raises temperature enough to bind protein to carbohydrates making the protein indigestible; the reaction is called the Maillard reaction. This may be compared to the formation of caramel when sugar and milk are heated together. Hay that has been changed this way will be brown, just like caramel. Horse owners generally avoid brown hay, so this reaction should not be of significance when purchasing hay for horses.

Carbohydrate loss may also occur when mold feeds on the hay. Again, horse owners know better than to buy hay that is moldy, because horses cannot tolerate moldy hay like cows can. Hay baled between 12-15 % moisture, which should be the target for good quality horse hay, will not heat up, should not mold if stored properly and therefore will not change in quality from the time it is baled for several years if stored in a dry barn or shed in an arid environment.

In some very humid climates, such as the United Kingdom, the southern United States, or some tropical regions, it may be nearly impossible to bale and store hay at less than 12% moisture. The stable moisture content of baled and stacked hay will be dependent on ambient humidity. Under these difficult conditions, horse owners may assume that brownish, slightly musty hay is the best they can get. If hay is baled at over 15% moisture, heating and molding may occur, resulting in loss of nutrients. Horse owners should not purchase or test such hay until the heating period is over and the extent of the damage is known. It's not so much a case of waiting to see how much the nutrients have changed, but waiting to see if it will be fit to purchase at all for horse feed. Even when baled too wet, once the heating period is over and the hay has dried down in the stack, which should occur within a month, loss of protein, carbohydrates and minerals stops. Only high amounts of continually growing mold would lower the nutrient content after this period. When stored away from rain and high humidity, nutritional content of hay does not change over a couple of years except for fragile vitamins.

Summary:

No nutrients quantifiable by hay analysis are lost during 9-13 months of storage in hay that is baled between 12-15% moisture and properly stored in a dry climate. There is no advantage to purchasing year old hay for horses with lower nutritional requirements.

Buckmaster, D.R., Indoor Hay Storage: Dry Matter Loss and Quality Changes, factsheet PSU/92M, Penn State University
<http://www.age.psu.edu/extension/factsheets/i/i102.pdf>

Coblentz W. K., J. O. Fritz, K. K. Bolson, and R. C. Cochran, Quality Changes in Alfalfa Hay During Storage in Bales. 1996. J. Dairy Sci. 79:873-885