



MOTIVATING LANDOWNERS TO PURSUE, COMMIT, AND DELIVER ON-THE-GROUND CONSERVATION PRACTICES

MIDDLE PARK CONSERVATION DISTRICT

PO BOX 265 106 S. 2ND ST.

KREMMLING, CO 80459

PH: 970-724-3456, EXT 4

middleparkcd@gmail.com www.middleparkcd.com

Taking Hay Samples

- 1) **Use a hay corer to take your sample:** Contact MPCD (970-724-3456 ext 4 or middleparkcd@gmail.com) to borrow our hay corer.
 - a. Use a hay corer (pic 1) to collect the sample. Reaching into a bale of hay with your hand and pulling out a sample is not accurate. A hay probe allows you to take a good cross section of the bale, getting a representative sample of both leaves and stems.
 - b. Connect the hay corer to a cordless drill (pic 2)
 - i. Drill it into the end of a square bale so that you are drilling through several flakes of hay. If drilling into round bales, drill through the netted or twined side of the bale so you are drilling through the layers into the core of the bale (pics 3 and 4)
 - ii. Pull the corer out of the bale and remove the corer from the drill. Place the end of the corer that went into the drill into the quart-sized Ziploc bag (there is a small hole at that end that the hay will come out of). Place the wooded plunger into the end of corer and push the hay into the Ziploc bag through the small hole (pic 5).
 - iii. Make sure the sample bag is clearly labeled. Continue reading for importance of taking samples from multiple bales and differentiating samples by timing, location, etc.
 - iv. If you want MPCD to send in your sample, bring your labeled sample(s) back with the hay corer and we will send it off for testing. The standard test we usually request costs about \$33 and includes dry matter, crude protein, NDF, ADF, TDN, NE, ME, DE, and minerals.



Picture 1 (drill, corer, quart-sized bag for sample)



Picture 2 (corer connected to drill)



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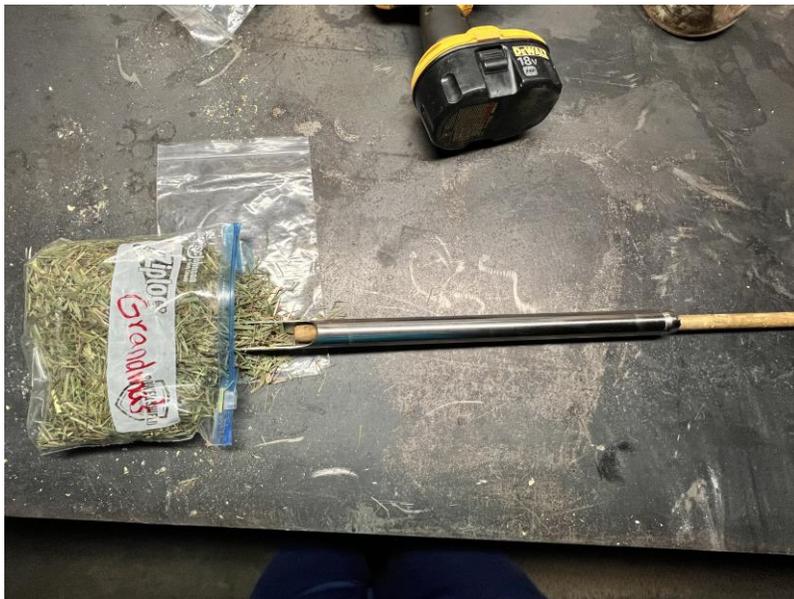
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Picture 3 (drill into end of square bale)



Picture 4 (drill into netted/twined side of round bale)



Picture 5 (plunge hay sample into plastic bag through small hole)

- 2) **Take cores from several bales for better representation of field or stack.** Take cores from several bales within a lot of hay to get a more accurate average of hay quality. On large round bales, if the outer layer is weathered and not going to be eaten by livestock then pull away the weathered layer and sample from that point going in towards the core of the bale.
- 3) **Differentiate samples of hay by timing of harvest, quality of harvest, and location.** A sample of hay can be determined by species, cutting date and location. For example, hay cut in July would be a different sample than hay cut in August or September. Hay that was rained on during harvest would likely be a separate sample than non-rained on hay. Also, you might want to do different samples for different fields or haystacks.



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Interpreting Your Hay Results

By testing your hay, you will have the knowledge to actively manage your herd's nutritional needs like never before. Now that you have your results, WHAT DO THEY MEAN?

The most basic Forage Test will test for Moisture, Crude Protein (CP), Acid Detergent Fiber (ADF), and Neutral Detergent Fiber (NDF). Total Digestible Nutrients (TDN) and Net Energy (NE) are calculated values based on Protein and Fiber results. **ALWAYS LOOK AT THE DRY MATTER BASIS COLUMN!!!** Crude Protein (CP) is a measure of the Nitrogen in the feedstuff and is commonly used as a standard for gauging protein requirements for animals. **Higher Crude Protein values are better.** Acid Detergent Fiber (ADF) is a measure of Feed Digestibility while Neutral Detergent Fiber (NDF) is a measure of Feed Intake/Satiation. **Lower values are better for both ADF & NDF!** The value for Total Digestible Nutrients (TDN) is the sum of all the digestible nutrients in a feedstuff and is used as a common measurement for Energy. TDN is especially useful for roughage-based diets. Net Energy (NE) also estimates energy but is more applicable to concentrate-based diets. Both of these values are calculated from ADF. **With either TDN or NE, Higher values are better!**

In general, forages that contain less than 70% NDF and more than 8% crude protein (Dry Matter Basis) will contain enough digestible protein and energy, vitamins, and minerals to maintain grown maintenance animals. However, growing, gestating, and lactating animals have higher nutrient requirements.

Additional Helpful Links for Interpreting Hay Results & Ideal Nutrient Levels:

Penn State: <https://extension.psu.edu/understanding-a-hay-analysis>

U of Minnesota: <https://extension.umn.edu/horse-nutrition/understanding-your-hay-analysis>

Ohio State University: <https://u.osu.edu/beef/2009/10/28/forage-analysis-sampling-and-interpretation-of-results/>

See the charts below for more specifics on hay quality!!!!

Table 4: Hay quality classification based on forage testing.

Quality Standards	% DM Analyzed ¹			% DM Calculated ¹			
	CP2	ADF	NDF	TDN	DDM	DMI3	RFV
Prime	>19	<31	<40	>60	>65	>3.0	<151
1	17 - 19	31 - 55	40 - 46	59 - 56	62 - 65	3.0 - 2.6	151 - 125
2	14 - 16	36 - 40	47 - 53	55 - 52	58 - 61	2.5 - 2.3	124 - 103
3	11 - 13	41 - 42	54 - 60	52 - 51	56 - 57	2.2 - 2.0	102 - 87
4	8 - 10	43 - 45	61 - 65	50 - 49	53 - 55	1.9 - 1.8	86 - 75
5	<8	>45	>65	<49	< 53	< 1.8	<75

¹ Values in the columns are expressed in terms of percent dry matter, except for RFV and DMI.

² Abbreviations over columns are: CP = crude protein; ADF = acid detergent fiber; NDF = neutral detergent fiber; TDN = total digestible nutrient; DDM = digestible dry matter; RFV = relative feed value; DMI = dry matter intake.

³ Based on percent of body weight (% BW).

Source: Coppock, 1997.



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Testing Method	Description/Comment
Sensory Evaluation	
Stage of maturity	Look for the presence of seed heads (grass forages) or flowers or seed pods (legumes), indicating more mature forages
Leaf to Stem ratio	Look at forage and determine whether the stems or leaves are more obvious; good-quality legume forages will have a high proportion of leaves, and stems will be less obvious and fine
Color	Color is not a good indicator of nutrient content, but bright green color suggests minimal oxidation; yellow hay indicates oxidation and bleaching from sun, and hay will have lower vitamins A and E content
Foreign Objects	Look for presence and amount of inanimate objects (twine, wire, cans, etc.), weeds, mold, or poisonous plants
Touch	Feel stiffness or coarseness of leaves and stems; see if alfalfa stems wrap around your finger without breaking; good-quality hay will feel soft and have fine, pliable stems
Smell	Good quality hay will have a fresh mowed grass odor; no musty or moldy odors

Table from <http://extension.psu.edu/animals/camelids/nutrition/determining-forage-quality-understanding-feed-analysis>

NUTRIENT REQUIREMENTS

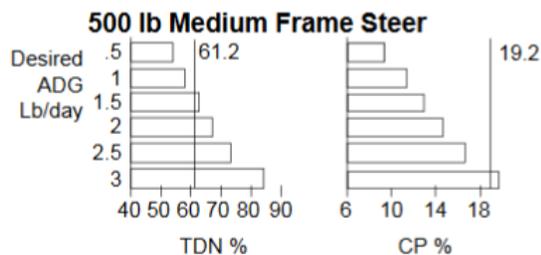
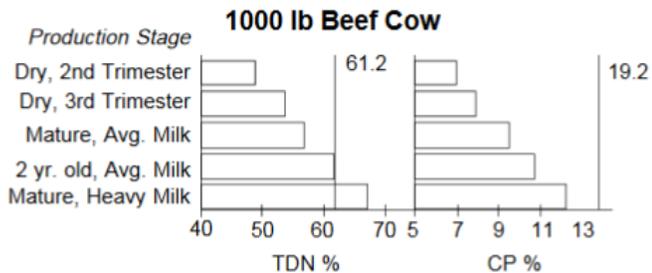
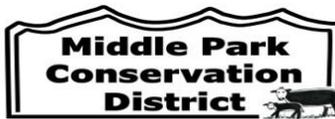


Chart from <http://www2.ca.uky.edu/agcomm/pubs/id/id101/id101.pdf>



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Table 2. Nutrient requirements for dry beef cows 1000, 1200, 1400 lbs.

	Months to calving				
	5	4	3	2	1
1000 lb cow					
DM intake, lbs/d	19.8	20.3	20.9	21.0	21.4
TDN, lbs/d	9.5	9.9	10.4	11.2	12.2
NEm, Mcal/d	8.12	8.52	9.20	10.29	11.61
CP, lbs/d	1.33	1.40	1.48	1.64	1.88
1200 lb cow					
DM intake, lbs/d	22.7	23.3	23.9	24.1	24.6
TDN, lbs/d	10.9	11.4	12.0	12.8	14.0
NEm, Mcal/d	9.30	9.79	10.52	11.81	13.53
CP, lbs/d	1.54	1.61	1.72	1.90	2.19
1400 lb cow					
DM intake, lbs/d	25.5	26.2	26.8	27.0	27.6
TDN, lbs/d	12.3	12.8	14.2	14.4	15.8
NEm, Mcal/d	10.46	11.00	11.79	13.23	15.18
CP, lbs/d	1.73	1.81	1.93	2.13	2.46

Adapted from Beef NRC (1996)

Intake and nutrient concentrations are expressed on a dry matter basis.

Table from <https://fyi.uwex.edu/wbic/files/2011/11/Hay-feed-analysis-draft-4.pdf>

Table I. Expected feed consumption by horses (percent body weight)¹

	<i>Forage</i>	<i>Concentrate</i>	<i>Total</i>
Mature horses			
Maintenance	1.5-2.0	0-0.5	1.5-2.0
Mares, late gestation	1.0-1.5	0.5-1.0	1.5-2.0
Mares, early lactation	1.0-2.0	1.0-2.0	2.0-3.0
Mares, late lactation	1.0-2.0	0.5-1.5	2.0-2.5
Working horses			
Light work ²	1.0-2.0	0.5-1.0	1.5-2.5
Moderate work ³	1.0-2.0	0.75-1.5	1.75-2.5
Intense work ⁴	0.8-1.5	1.0-2.0	2.0-3.0
Young horses			
Nursing foal, 3 months	0	1.0-2.0	2.5-3.5
Weanling foal, 6 months	0.5-1.0	1.5-3.0	2.0-3.0
Yearling foal, 12 months	1.0-1.5	1.0-2.0	1.8-3.0
Long yearling, 18 months	1.0-1.5	1.0-1.5	2.0-2.5
Two-year-old, 24 months	1.0-1.5	1.0-1.5	1.75-2.5

¹Air-dry feed (about 90% DM).

²Examples are horses used in pleasure, equitation or working 1-3 hours per day.

³Examples are horses in ranch work, roping, cutting, barrel racing, jumping, etc. or working 3-5 hours per day.

⁴Examples are horses in race training, polo, etc. or working more than 5 hours per day.

Table from: <http://alec.unl.edu/documents/cde/2017/livestock-management/2017-basics-of-feeding-horses-feeding-mgmt.pdf>



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Table 1. Minimum daily nutrient requirements for mature horses.*

	Mature body weight lbs.	Digest energy M.cal/ day	Crude protein lbs./ day	% of diet	Calcium grams/ day	% of diet	Phosphorus grams/ day	% of diet	Vit A 1,000 IU's/ day
Mature horse at rest (maintenance)	440 880 1100 1980	7.4 13.4 16.4 24.1	.65 1.18 1.45 2.13	8 8 8 8	8 16 20 36	.25 .25 .25 .25	6 11 14 25	.20 .20 .20 .20	6.0 12.0 15.0 27.0
Mature horse at moderate work**	440 880 1100 1980	11.1 20.1 24.6 36.2	.98 1.77 2.17 3.20	10 10 10 10	14 25 30 44	.30 .30 .30 .30	10 17 21 32	.25 .25 .25 .25	9.0 18.0 22.0 40.0
Mares, last 30 days of pregnancy	440 880 1100 1980	8.9 16.1 19.7 29.0	.86 1.56 1.91 2.81	11 11 11 11	17 31 37 55	.50 .50 .50 .50	13 23 28 42	.40 .40 .40 .40	12.0 24.0 30.0 54.0
Mares, peak of lactation*** 3 months	440 880 1100 1980	13.7 22.9 28.3 45.5	1.52 2.52 3.15 5.67	13 13 13 13	27 45 56 101	.50 .50 .50 .50	18 29 36 65	.35 .35 .35 .35	12.0 24.0 30.0 54.0

* From Nutrient Requirements of Horses, 1989, National Research Council.

** Examples are horses used in ranch work, roping, cutting, barrel racing, jumping, etc.

***Lactation level is assumed to be 3% of body weight/day.

Table from: <https://www.extension.purdue.edu/extmedia/as/as-429.html>