Colorado State University
Extension

Feed Composition for Cattle and Sheep

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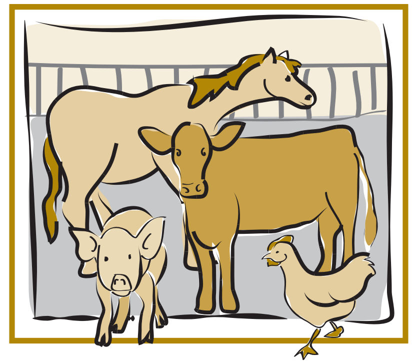

by T.L. Stanton*
Revised by S. LeValley**

Nutrition research spanning more than 100 years has defined the nutrients required by animals. Using this information, rations can be formulated from feeds and ingredients to meet these requirements. Animals fed these rations should not only remain healthy but be productive and efficient.

The ultimate goal of feed analysis is to predict the productive response of animals when they are fed rations of a given composition. This is the real reason for information on feedstuff composition.

Table Values for Feedstuff Composition

Feedstuffs vary in composition. Unlike chemicals that are "chemically pure" and therefore have a constant composition, feeds vary in their composition for many reasons. Actual analysis of a feed to be used in a ration is more accurate than tabular data. Obtain and use actual analysis whenever possible.

Often, however, it is either impossible to determine actual compositional data, or there is insufficient time to obtain an analysis. Tabulated data are the next best source of information. When using tabulated data, remember that feeds vary in their composition. The organic constituents (e.g., crude protein, ether extract, crude fiber, acid detergent fiber and neutral detergent fiber) can vary as much as 15 percent, the mineral constituents as much as 30 percent, and the energy values at least 10 percent, from table values.

Therefore, the values shown can only be guides. For this reason they are called "typical values." They are not averages of published information. Some judgment was used in arriving at some of the values in the hope that the values will be realistic for use in cattle and sheep rations.

Feeds can be chemically analyzed for many things that may or may not be related to the response of the animals to which they are fed. In the accompanying table, certain chemical constituents are shown. The response of cattle and sheep when fed a feed, however, can be termed the biological response to the feed in question. This is a function of its chemical composition and the ability of the animal to derive useful nutrients from the feed.

The latter relates to the digestibility or availability of a nutrient in the feed for absorption into the body and its ultimate efficiency of use in the animal. This also depends on the nutrient status of the animal and the productive or physiological function being performed by the animal. Ground fence posts and shelled corn may have the same gross energy value in a bomb calorimeter, but have markedly different useful energy value (TDN, digestible energy, net energy) when consumed by the animal.

That means that the biological attributes of a feed have much greater meaning in predicting the productive response of animals. However, they are more difficult to accurately determine because there is an interaction between the chemical composition of the feed and the digestive and metabolic capabilities of the animal being fed.

Using Information Contained in the Table

Feed Names

The most obvious or commonly used feed names are given in the table. Feeds designated as "fresh" are feeds that are grazed or fed as fresh cut materials.

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Quick Facts

- Obtain and use actual feedstuff analysis whenever possible for ration formulation.
- If feedstuff compositional data is impossible to determine, tabulated data is the next best source of information.
- Since moisture content of feeds can vary greatly, it is important to express feedstuff composition on a dry matter basis.

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Dry Matter

Typical dry matter (DM) values are shown. However, the moisture content of feeds can vary greatly. Thus DM content can be the biggest reason for variation in the composition of feedstuffs on an "as fed basis." For this reason, the composition of chemical constituents and biological attributes of feeds are shown on a DM basis. Because DM can vary greatly, and because one of the factors regulating total feed intake is the DM content of feeds, ration formulation on a DM basis is more sound than using "as fed basis." To convert the values shown to an "as fed basis," multiply the decimal equivalent of the DM content times the compositional value shown in the table.

Protein

Crude protein (CP) values are shown for each feed. Crude protein is determined by taking the Kjeldahl nitrogen times (100/16 or 6.25). (Proteins contain 16 percent nitrogen on average.) Crude protein does not give any information on the actual protein and nonprotein content of a feed. Digestible protein has been included in many feed composition tables, but because of the large contribution of body protein to the apparent protein in the feces, digestible protein is more misleading than CP. Calculate digestible protein from the CP content of the ration fed to cattle or sheep by the following equation: % DP = 0.9 (% CP) - 3, where % DP and % CP are the ration values on a dry matter basis.

Rumen "by-pass" protein, or undegraded intake protein (UIP), represents the percent of protein that passes through the rumen without being degraded by rumen microorganisms. Like other biological attributes, these values are not constant. By-pass values for many feeds have not been determined. Reasonable estimates are difficult to make.

Degradable intake protein (DIP) is used to meet the nitrogen requirements of rumen micro-organisms. Nitrogen sources such as urea are the most economical sources of DIP. Balancing DIP and UIP sources provides a more accurate way of meeting the metabolizable protein needs of ruminants.

Crude, Acid Detergent and Neutral Detergent Fibers

After more than 100 years, crude fiber (CF) is declining in popularity as a measure of low digestible material in feeds. The major problem with CF is that variable amounts of lignin, which is not digestible, are removed from various feeds in the CF procedure. In the old scheme, the material removed was called nitrogen-free extract (NFE) and was thought to be more digestible than CF, even though many feeds have been shown to have a higher digestibility for CF than NFE. One reason CF remained in the analytical scheme for feedstuff analysis was its requirement for the determination of TDN.

Newer procedures have developed an alternate analytical scheme, namely, acid detergent fiber (ADF) and neutral detergent fiber (NDF). ADF is highly related to digestibility in the animal. NDF is related to voluntary intake of the feed and the availability of net energy from digestible energy. Both measures relate more directly to predicted animal performance, so they are more valuable than CF. Also, if TDN is replaced by other measures of energy value, there will be little use of the CF content of feeds. As more complete data on the ADF and NDF content of feeds are developed, CF will be dropped.

Minerals

Values are shown for only certain minerals. Calcium (Ca) and phosphorus (P) are important minerals in most feeding situations. Potassium (K) becomes important as the level of concentrate increases in the ration, or when nonprotein nitrogen is substituted for intact protein. Sulfur (S) also becomes more important as the level of nonprotein nitrogen increases in the ration.

Vitamins

Vitamins have been omitted from the table. Only vitamin A is of general practical importance in cattle and sheep feeding. The vitamin A and carotene in feeds depend largely on maturity and conditions at harvest and the length and conditions of storage. Therefore, it is probably unwise to rely entirely on harvested feeds as a source of vitamin A. Where roughages are being fed that contain good green color or are being fed as immature fresh forages (e.g., pasture), there will probably be sufficient vitamin A.

Energy

Four measures of the energy value of feeds are shown in the table. TDN is shown simply because there are more TDN values for feeds, and because this has become a standard system for expressing the energy value of feeds for cattle and sheep. There are several technical problems with TDN, however. There is a poor relationship between crude fiber and NFE digestibility in certain feeds. TDN also overestimates the value of roughages compared to concentrates in producing animals. Some have argued that energy is not measured in pounds or percent, so TDN is not a valid measure of energy. However, this is more a scientific argument than a criticism of the predictive value of TDN.

Digestible energy (DE) values also are shown. Many studies have shown there is a constant relationship between TDN and DE: There are 2 Mcals of DE per pound of TDN. Obviously, DE can be calculated by multiplying .02 times the percent TDN content. Because DE is measured in calories, it is technically preferred over TDN. With greater emphasis on ADF and NDF as replacements for CF and the use of the bomb calorimeter to measure DE directly, use of TDN should gradually decrease. It should be apparent, however, that the ability of TDN and DE to predict animal performance is exactly equal.

Interest in the use of **net energy** (NE) in evaluating feeds for cattle and sheep was renewed with the development of the California net energy system. The main reason is the improved predictability of results depending on whether feed energy is being used for maintenance (NEm) or growth (NEg). The major problem in using these NE values is predicting feed intake and, therefore, the proportion of feed that will be used for maintenance and growth.

Some use only the NEg values in formulating rations. This suffers the equal but opposite criticism mentioned for TDN – NEg overestimates the feeding value of concentrates relative to roughages. Others use the average of the two NE values, but this would be true only for cattle or sheep eating twice their maintenance requirement.

The most accurate way to use these NE values to formulate rations is to use the NEm value plus a multiplier times the NEg value, all divided by one plus the multiplier. The multiplier is the level of feed intake above maintenance relative to maintenance. For example, if 700-pound cattle are expected to eat 18 pounds of feed, 8 pounds of which are required for maintenance, then the NE value of the ration would be: NE = [NEg + (10/8) (NEg)] / [i + (10/8)]

There is no question as to the theoretical superiority of NE over either DE or TDN in predicting animal performance. This superiority is lost, however, if only NEg is used in formulating rations. So if NE is used, some combination of NEm and NEg is required.

Table 1. Typical composition of feeds for cattle and sheep. (All values except dry matter are shown on a dry matter basis.)

Feedstuff	DM %	CP %	By-Pass %	EE %	CF %	ADF %	NDF %	Ash %	Ca %	P %	K %	S %	Zn PPM	TDN %	DE Mcal/ lb.	NEm Mcal/ lb.	NEg Mcal/ lb.
Alfalfa cubes	91	18	35	2.0	29	34	45	11	1.3	0.23	1.9	0.35	18	57	1.14	0.56	0.25
Alfalfa dehydrated 17%	92	19	60	3.0	26	35	45	11	1.4	0.25	2.7	0.24	19	61	1.22	0.61	0.31
Alfalfa fresh	26	19	20	2.2	27	32	44	8	1.6	0.32	2.3	0.34	21	60	1.20	0.59	0.30
Alfalfa hay early bloom	90	18	20	2.2	29	35	47	8	1.4	0.25	2.3	0.30	18	60	1.20	0.59	0.30
Alfalfa hay midbloom	89	17	25	2.0	30	38	50	10	1.4	0.23	1.8	0.30	17	58	1.16	0.57	0.26
Alfalfa hay full bloom	88	16	30	1.8	34	41	56	8	1.3	0.20	1.7	0.29	17	53	1.06	0.52	0.18
Alfalfa hay mature	90	14	35	1.7	38	45	59	8	1.3	0.19	1.4	0.25	17	50	1.00	0.49	0.12
Alfalfa silage	30	18	20	3.0	30	35	46	8	1.5	0.28	2.4	0.30	17	54	1.08	0.53	0.20
Alfalfa silage wilted	36	17	25	3.0	30	35	46	8	1.5	0.28	2.4	0.30	17	58	1.16	0.57	0.26
Ammonium sulfate	99	132	0	0.0	0	0	0	–	–	–	–	24.20	–	0	0.00	0.00	0.00
Barley silage	32	10	25	4.0	34	–	–	10	0.3	0.30	1.6	0.17	29	50	1.00	0.49	0.12
Barley silage mature	40	9	35	4.0	34	–	–	10	0.2	0.15	1.5	0.15	–	60	1.20	0.59	0.30
Barley straw	88	4	–	1.9	42	57	82	7	0.3	0.05	2.0	0.15	7	49	0.98	0.48	0.11
Barley grain	89	12	30	2.0	6	7	20	3	0.1	0.42	0.5	0.16	25	83	1.66	0.89	0.60
Barley feed pearl byproduct	90	15	–	3.9	11	–	–	5	0.0	0.45	0.7	0.06	–	75	1.50	0.78	0.50
Barley grain screenings	89	13	–	2.6	9	–	–	4	0.0	0.40	0.1	0.15	–	81	1.62	0.87	0.58
Beans navy cull	90	24	–	1.4	5	–	–	6	0.1	0.05	1.4	0.26	–	84	1.68	0.91	0.61
Beet pulp wet	11	10	30	2.0	20	34	59	5	0.8	0.10	0.2	0.22	1	68	1.36	0.69	0.41
Beet pulp dried	91	9	35	0.8	21	34	59	5	0.7	0.08	0.2	0.22	1	72	1.44	0.74	0.47
Beet pulp wet with molasses	24	12	25	0.5	16	27	47	9	0.6	0.10	1.8	0.36	11	76	1.52	0.80	0.52
Beet pulp dried with molasses	92	12	25	0.5	16	27	47	9	0.6	0.10	1.8	0.36	11	76	1.52	0.80	0.52
Beet tops (sugar)	20	13	–	1.4	9	–	–	25	0.7	0.24	4.8	0.45	20	58	1.16	0.57	0.26
Beet top silage	25	10	–	2.0	10	–	–	38	1.2	0.22	5.7	0.57	–	52	1.04	0.51	0.16
Blood meal	92	80	80	1.3	1	–	–	5	0.3	0.26	0.1	0.43	5	61	1.22	0.61	0.31
Bluestem fresh mature	61	6	–	2.5	34	–	–	4	0.3	0.14	1.0	0.05	28	50	1.00	0.49	0.12
Bone meal steamed	95	13	–	11.6	1	0	0	77	27.0	12.74	0.2	2.50	290	16	0.32	0.26	0.00
Brewers grains wet	24	26	60	6.5	15	22	42	5	0.3	0.60	0.1	0.32	50	81	1.62	0.87	0.58
Brewers dried grain	92	28	60	7.5	15	22	42	4	0.3	0.60	0.1	0.32	50	81	1.62	0.87	0.58
Brewers yeast dried	94	48	–	1.0	3	–	–	7	0.1	1.56	1.8	0.41	41	79	1.58	0.84	0.55
Brome grass fresh immature	32	15	–	4.1	28	33	54	10	0.4	0.39	2.7	0.20	–	64	1.28	0.64	0.36
Brome grass hay	89	10	–	2.5	35	41	69	9	0.5	0.23	2.5	0.16	17	55	1.10	0.54	0.21
Calcium carbonate	99	0	–	0.0	0	0	0	99	39.0	0.04	0.0	0.09	0	0	0.00	0.00	0.00
Canarygrass hay	91	9	–	2.7	33	36	64	8	0.4	0.25	2.6	0.14	18	53	1.06	0.52	0.18
Carrot pulp	14	6	–	7.8	19	23	–	9	–	–	–	–	–	62	1.24	0.62	0.33
Carrot root fresh	12	10	–	1.4	10	9	9	9	0.4	0.34	2.7	0.17	–	83	1.66	0.89	0.60
Carrot tops	16	13	–	3.8	18	23	–	15	1.9	0.19	1.9	–	–	73	1.46	0.76	0.48
Cattle manure dried	92	17	–	2.6	34	37	55	14	1.2	1.00	0.5	1.78	240	38	0.76	0.39	0.00
Cheatgrass fresh immature	21	16	–	2.7	23	–	–	10	0.6	0.28	–	–	–	68	1.36	0.69	0.41
Clover ladino fresh	19	25	–	4.8	14	–	–	11	1.3	0.42	2.2	0.20	39	69	1.38	0.70	0.43
Clover ladino hay	90	21	–	2.0	22	32	36	9	1.7	0.32	2.4	0.22	17	61	1.22	0.61	0.31
Clover red fresh	24	18	–	4.0	24	33	44	9	1.7	0.26	2.0	0.17	23	64	1.28	0.64	0.36

Table 1. Continued.

Feedstuff	DM %	CP %	By-Pass %	EE %	CF %	ADF %	NDF %	Ash %	Ca %	P %	K %	S %	Zn PPM	TDN %	DE Mcal/ lb.	NEm Mcal/ lb.	NEg Mcal/ lb.
Clover red hay	88	15	–	2.9	30	41	56	8	1.4	0.22	1.9	0.17	17	57	1.14	0.56	0.25
Coffee grounds	88	13	–	15.0	41	68	77	2	0.1	0.08	–	–	–	20	0.40	0.35	0.00
Corn whole plant pelleted	91	9	45	2.4	21	–	–	6	0.5	0.24	1.0	0.14	–	63	1.26	0.63	0.34
Corn fodder	80	9	45	2.4	25	29	48	7	0.3	0.18	1.0	0.14	–	67	1.24	0.68	0.40
Corn stover mature	80	6	–	1.3	35	40	70	7	0.5	0.09	1.6	0.17	–	59	1.18	0.58	0.28
Corn silage milk stage	26	8	25	2.8	26	31	--	6	0.3	0.24	1.6	0.12	25	67	1.24	0.68	0.40
Corn silage mature well eared	36	8	40	2.7	23	28	50	7	0.3	0.20	1.0	0.10	24	69	1.38	0.70	0.43
Corn grain dent yellow	89	10	50	4.1	3	3	10	2	0.0	0.30	0.4	0.10	17	89	1.78	0.98	0.67
Corn grain hi-lysine	92	12	–	4.4	4	–	–	2	0.0	0.24	0.3	0.11	–	89	1.78	0.98	0.67
Corn and cob meal	87	9	50	3.7	9	10	28	2	0.1	0.24	0.5	0.18	10	82	1.64	0.88	0.59
Corn cobs	90	3	50	0.5	36	39	88	2	0.1	0.04	0.8	0.35	5	48	0.26	0.47	0.09
Corn bran	90	10	–	6.3	10	–	51	3	0.0	0.17	0.7	0.08	–	76	1.52	0.80	0.52
Corn gluten feed	90	26	–	2.9	9	–	41	7	0.4	0.75	0.6	0.20	100	82	1.64	0.88	0.59
Corn gluten meal	91	45	65	2.5	5	9	37	4	0.2	0.50	0.2	0.60	45	84	1.68	0.91	0.61
Defluorinated phosphate	99	0	–	0.0	0	0	0	95	32.6	18.07	1.0	–	100	0	0.00	0.00	0.00
Diammonium phosphate	98	115	0	0.0	0	0	0	35	0.5	20.41	0.0	2.16	–	0	0.00	0.00	0.00
Dicalcium phosphate	96	0	–	0.0	0	0	0	94	22.0	18.65	0.1	1.10	70	0	0.00	0.00	0.00
Distillers grain barley	90	30	60	3.7	18	–	–	4	0.1	0.27	–	–	–	75	1.50	0.78	0.50
Distillers grain corn	91	30	65	8.2	14	16	41	2	0.1	0.45	0.2	0.46	35	84	1.68	0.91	0.61
Distillers grain corn with solubles	92	29	50	10.0	10	18	44	5	0.3	0.85	0.7	0.32	90	88	1.76	0.97	0.65
Distillers silage corn	7	29	65	8.0	8	–	–	4	0.1	0.65	–	–	–	86	1.72	0.94	0.63
Distillers dried solubles	93	30	–	9.5	4	7	23	8	0.4	1.40	1.8	0.40	91	88	1.76	0.97	0.65
Fat animal poultry	99	0	–	99.0	0	0	0	0	0.0	0.00	0.0	–	–	195	3.90	2.38	1.82
Feathermeal hydrolized	94	91	50	3.3	2	20	20	4	0.2	0.78	0.3	1.80	53	68	1.36	0.69	0.41
Garbage municipal cooked	23	16	–	23.3	8	50	59	11	1.6	0.45	–	–	–	75	1.50	0.78	0.50
Grain screenings	90	14	–	5.5	14	–	–	9	0.5	0.43	–	–	17	65	1.30	0.65	0.37
Grain dust	92	10	–	2.5	15	–	–	10	0.3	0.18	–	–	42	73	1.46	0.76	0.48
Grape pomace stemless	91	12	–	7.5	32	50	53	9	0.6	0.06	0.6	–	24	30	0.60	0.37	0.00
Grass silage	26	12	20	4.6	34	38	66	9	0.8	0.22	2.0	–	29	61	1.22	0.61	0.31
Hominy feed	90	12	–	7.7	6	12	50	3	0.1	0.58	0.7	0.04	3	94	1.88	1.05	0.72
Hop leaves	37	15	–	3.6	15	–	–	35	2.8	0.64	–	–	–	49	0.98	0.48	0.11
Hop vine silage	30	15	–	3.1	21	–	v	20	3.3	0.37	1.8	0.22	44	53	1.06	0.52	0.18
Hops spent	89	22	–	4.0	28	0	--	7	1.6	0.60	–	–	–	39	0.78	0.40	0.00
Limestone ground	98	0	–	0.0	0	–	–	98	38.0	0.02	–	–	–	0	0.00	0.00	0.00
Linseed meal solvent	91	39	40	1.9	10	18	25	6	0.4	1.00	1.4	0.47	60	76	1.52	0.80	0.52
Meadow hay	92	8	–	2.5	33	–	–	9	0.6	0.17	1.6	–	---	46	0.92	0.45	0.05
Meat meal	94	55	65	9.7	3	–	–	29	9.4	4.74	0.6	0.50	85	71	1.42	0.73	0.46
Milo grain	89	11	60	3.2	3	6	20	2	0.0	0.32	0.4	0.13	17	85	1.70	0.92	0.62
Mint slug silage	27	14	–	1.8	24	–	–	16	1.1	0.57	–	–	–	55	1.10	0.54	0.21
Molasses beet	77	9	0	0.2	0	0	0	11	0.2	0.03	6.1	0.60	18	79	1.58	0.84	0.55
Molasses cane	76	5	0	0.0	0	0	0	10	1.1	0.08	3.6	0.46	30	75	1.50	0.78	0.50
Molasses cane dried	94	10	0	0.6	3	0	0	14	1.2	0.15	4.0	0.46	30	74	1.48	0.77	0.49
Molasses citrus	65	9	0	0.3	0	0	0	9	2.0	0.25	0.2	0.23	137	75	1.50	0.78	0.50
Molasses wood (Hemicellulose)	61	1	0	0.7	1	–	–	8	1.4	0.06	0.1	0.05	–	76	1.52	0.80	0.52
Monoammonium phosphate	98	74	0	0.0	0	0	0	24	0.3	24.70	0.0	1.42	81	0	0.00	0.00	0.00
Mono-dicalcium phosphate	97	0	–	0.0	0	0	0	94	16.7	21.10	0.1	–	70	0	0.00	0.00	0.00
Oat hay	87	9	–	2.1	30	38	63	9	0.2	0.22	1.0	0.30	39	59	1.18	0.58	0.28
Oat silage	34	11	25	3.8	30	–	–	10	0.4	0.25	3.4	0.32	35	60	1.20	0.59	0.30
Oat straw	90	4	--	2.3	41	46	70	8	0.3	0.10	2.2	0.22	6	50	1.00	0.49	0.12
Oats grain	89	13	30	4.0	12	17	31	4	0.1	0.40	0.5	0.22	30	74	1.48	0.77	0.49

Table 1. Continued.

Feedstuff	DM %	CP %	By-Pass %	EE %	CF %	ADF %	NDF %	Ash %	Ca %	P %	K %	S %	Zn PPM	TDN %	DE Mcal/ lb.	NEm Mcal/ lb.	NEg Mcal/ lb.
Oats groats	91	18	25	5.5	3	–	–	2	0.1	0.47	0.4	0.22	–	93	1.86	1.03	0.71
Oat meal feeding	90	17	20	6.0	4	–	–	3	0.1	0.46	0.5	0.25	–	94	1.88	1.05	0.72
Oat mill byproduct	89	9	–	3.0	21	–	–	6	0.1	0.24	0.6	0.24	–	33	0.66	0.37	0.00
Oat hulls	93	4	–	1.5	32	44	78	7	0.2	0.15	0.6	0.15	–	37	0.74	0.39	0.00
Orange pulp dried	89	9	–	1.8	9	–	–	4	0.7	0.11	–	–	–	82	1.64	0.88	0.59
Orchardgrass fresh immature	24	18	25	5.0	24	29	50	11	0.4	0.40	2.7	0.22	20	65	1.30	0.65	0.37
Orchardgrass hay	88	11	30	3.3	34	40	70	7	0.3	0.28	2.8	0.26	18	59	1.18	0.58	0.28
Pea vine hay	89	10	–	1.8	32	–	–	7	1.2	0.21	1.8	0.17	15	60	1.20	0.59	0.30
Pea vine silage	24	13	–	3.3	31	49	59	8	1.3	0.24	1.4	0.29	–	57	1.14	0.56	0.25
Pea straw	89	7	–	1.3	45	–	–	7	--	0.11	1.1	0.20	–	50	1.00	0.49	0.12
Peas cull	89	25	–	1.5	8	–	–	5	0.2	0.43	1.1	0.26	30	82	1.64	0.88	0.59
Peanut hulls	92	7	–	1.3	63	65	74	5	0.2	0.07	0.9	–	–	22	0.44	0.35	0.00
Peanut meal solvent	91	52	30	1.3	11	--	14	5	0.2	0.65	1.2	0.30	22	77	1.54	0.81	0.53
Peanut skins	92	17	–	22.0	13	20	28	3	–	–	–	–	–	0	0.00	0.00	0.00
Potato vine silage	15	15	–	3.7	26	–	–	19	2.1	0.29	4.0	0.37	–	59	1.18	0.58	0.28
Potatoes cull	21	10	0	0.4	2	–	–	5	0.0	0.24	2.2	0.09	–	80	1.60	0.85	0.56
Potato waste wet	14	7	0	1.5	9	–	–	3	0.2	0.26	1.3	0.11	12	82	1.64	0.88	0.59
Potato waste dried	89	8	0	0.5	7	–	–	5	0.1	0.13	1.2	–	–	85	1.70	0.92	0.62
Potato waste wet with lime	17	5	0	0.3	10	–	–	9	4.2	0.18	–	–	–	80	1.60	0.85	0.56
Potato waste filter cake	14	5	0	7.7	2	–	–	3	0.1	0.19	0.2	–	–	77	1.54	0.81	0.53
Poultry litter dried	87	26	0	3.0	18	–	–	19	2.7	1.80	1.7	1.26	340	64	1.28	0.64	0.36
Poultry manure dried	89	28	0	2.1	13	15	35	29	9.0	2.44	2.0	0.18	445	54	1.08	0.53	0.20
Prairie hay	91	7	–	2.0	35	–	–	8	0.4	0.13	1.1	0.06	34	50	1.00	0.49	0.12
Rapemeal solvent	91	41	20	2.2	14	–	–	8	0.7	1.14	1.4	0.28	66	70	1.40	0.72	0.44
Rye straw	89	4	–	1.5	44	55	71	6	0.3	0.10	1.0	0.11	–	44	0.88	0.43	0.01
Rye grain	89	13	–	1.7	2	–	–	2	0.1	0.38	0.5	0.17	34	81	1.62	0.87	0.58
Safflower meal solubles	91	22	–	1.0	33	41	59	6	0.3	0.73	1.0	0.28	44	55	1.10	0.54	0.21
Safflower meal dehulled solubles	91	48	–	0.6	9	–	–	7	0.3	1.83	1.3	0.22	36	76	1.52	0.80	0.52
Sagebrush fresh	50	13	–	9.2	25	28	36	10	1.0	0.25	–	0.22	–	50	1.00	0.49	0.12
NA tripolyphos	96	0	–	0.0	0	0	0	96	0.0	25.98	0.0	0.00	–	0	0.00	0.00	0.00
Sorghum stover	85	5	–	2.1	33	–	–	10	0.4	0.11	1.2	–	–	54	1.08	0.53	0.20
Sorghum silage	28	8	50	2.8	26	28	39	7	0.3	0.15	1.6	0.09	24	58	1.16	0.57	0.26
Soybean hay	89	15	–	2.2	37	–	–	8	1.3	0.32	1.0	0.24	24	52	1.04	0.51	0.16
Soybean straw	88	5	–	1.4	44	54	70	6	1.6	0.06	0.6	0.26	–	42	0.84	0.42	0.00
Soybeans whole	91	42	40	19.2	6	10	–	5	0.3	0.63	1.8	0.24	60	92	1.84	1.02	0.70
Soybean meal solvent 44% protein	89	50	35	1.3	6	10	14	7	0.3	0.75	2.2	0.40	52	84	1.68	0.91	0.61
Soybean meal solvent 49% protein	90	55	25	1.2	3	6	10	6	0.3	0.71	2.2	0.42	61	87	1.74	0.95	0.64
Soybean flake (hull)	91	12	10	2.8	39	47	65	4	0.6	0.17	1.0	0.09	24	71	1.42	0.73	0.46
Sudangrass fresh immature	18	17	–	3.9	23	29	55	9	0.5	0.31	2.0	0.04	–	70	1.40	0.72	0.44
Sudangrass hay	89	9	–	1.8	36	43	68	10	0.4	0.30	2.1	0.06	30	57	1.14	0.56	0.25
Sudangrass silage	23	10	–	3.1	34	42	65	10	0.4	0.25	3.5	0.05	–	55	1.10	0.54	0.21
Sunflower meal solvent	93	50	–	3.1	12	–	40	8	0.5	0.80	1.1	0.33	21	65	1.30	0.65	0.37
Sunflower meal with hulls	91	32	–	1.4	27	–	–	7	0.4	0.96	1.1	0.30	100	57	1.14	0.56	0.25
Sunflower hulls	90	5	–	2.2	25	63	–	3	0.0	0.11	–	–	–	40	0.80	0.41	0.00
Timothy fresh pre-bloom	26	11	20	3.8	32	37	64	7	0.4	0.28	2.1	0.21	24	64	1.28	0.64	0.36
Timothy hay early bloom	88	12	25	2.6	33	43	68	6	0.5	0.25	0.9	0.21	–	59	1.18	0.58	0.28
Timothy hay full bloom	88	8	35	2.5	34	45	70	5	0.4	0.20	1.6	0.13	17	57	1.14	0.56	0.25
Timothy silage	34	10	25	3.4	35	–	–	7	0.6	0.29	1.7	0.15	–	59	1.18	0.58	0.28
Tomato pomace dried	92	23	–	10.6	26	50	55	6	0.4	0.59	3.6	–	–	64	1.28	0.64	0.36
Triticale silage	38	12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 1. Continued.

Feedstuff	DM %	CP %	By-Pass %	EE %	CF %	ADF %	NDF %	Ash %	Ca %	P %	K %	S %	Zn PPM	TDN %	DE Mcal/ lb.	NEm Mcal/ lb.	NEg Mcal/ lb.
Triticale	90	16	25	4.6	4	–	–	2	0.1	0.34	0.4	0.17	–	86	1.72	0.94	0.63
Urea 46% N	99	288	0	0.0	0	0	0	0	0.0	0.00	0.0	0.00	0	0	0.00	0.00	0.00
Wheat fresh pasture	21	28	–	4.0	18	30	52	14	0.4	0.40	3.3	0.22	–	69	1.38	0.70	0.43
Wheat silage	28	10	–	3.2	28	–	–	8	0.3	0.27	1.2	0.23	25	60	1.20	0.59	0.30
Wheat straw	88	4	–	1.5	42	56	85	7	0.2	0.08	1.2	0.14	7	44	0.88	0.43	0.01
Wheat grain	89	13	25	2.1	3	4	13	2	0.0	0.35	0.4	0.17	17	89	1.78	0.98	0.67
Wheat grain hard	89	14	–	2.0	3	6	–	2	0.1	0.45	0.5	0.17	16	89	1.78	0.98	0.67
Wheat grain soft	89	12	–	2.0	3	4	14	2	0.1	0.35	0.4	0.17	16	89	1.78	0.98	0.67
Wheat bran	89	18	–	4.8	11	14	47	7	0.1	1.30	1.4	0.25	105	70	1.40	0.72	0.44
Wheat midds	88	18	50	3.9	3	–	37	3	0.1	0.90	1.1	0.20	72	90	1.80	0.99	0.68
Wheat mill run	90	17	20	4.7	9	–	–	6	0.1	1.10	1.4	0.28	---	75	1.50	0.78	0.50
Wheat shorts	89	20	20	5.4	7	–	–	5	0.1	0.99	1.1	0.19	118	80	1.60	0.85	0.56
Wheatgrass crested fresh early bloom	37	11	–	1.6	26	–	–	7	0.3	0.30	–	–	–	60	1.20	0.59	0.30
Wheatgrass crested fresh full bloom	50	10	–	1.6	33	–	–	7	0.4	0.28	–	–	–	55	1.10	0.54	0.21
Wheatgrass crested hay	92	11	–	2.4	33	36	–	7	O.3	0.15	2.0	–	32	54	1.08	0.53	0.20
Wheat dried	96	16	0	0.9	0	0	0	10	1.0	0.81	1.5	1.10	3	82	1.64	0.88	0.59