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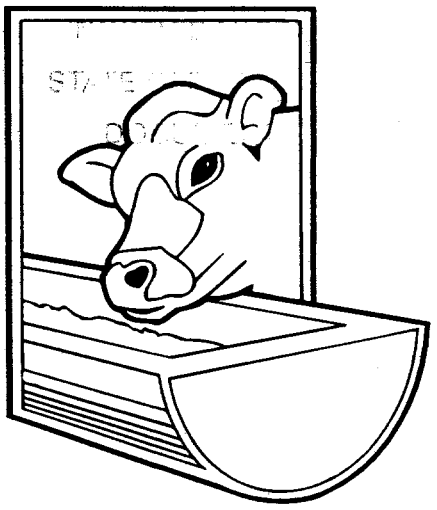

Nutritional Guidelines for Backgrounding Calves

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Backgrounding is a common practice in many beef cattle operations in North Dakota. In some operations it serves as a way to add value to feedstuffs or to increase revenue from the beef cattle enterprise. This circular details nutrient requirements for backgrounding calves and gives information related to the nutrient content of feeds available in North Dakota.

Nutrient Requirements of the Growing Calf

Energy

Growing cattle have energy requirements for both maintenance and gain. Energy required for maintenance refers to the amount of energy necessary to result in no net loss or gain of body tissues. Energy requiring processes involved in maintenance include body temperature regulation, essential metabolic processes and enzymatic reactions, and physical activity. Increased level of activity (distance traveled) can also increase energy requirements. This is particularly important in grazing animals. When requirements for maintenance have been met, the animal can begin to utilize additional energy for productive purposes (growth, lactation).

Average daily gain of cattle in backgrounding operations is directly affected by the amount of energy consumed daily. Energy intake is a function of dry matter intake and dietary energy concentration. Table 1 details energy requirements for calves of differing weights and average daily gains. More energy is required for heavier cattle and cattle gaining at more rapid average daily gains.

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For a given average daily gain, energy concentration required in the diet generally decreases as calves grow larger and intake increases. Conversely, for a given weight, energy concentration required in the diet increases for more rapid average daily gains (assuming dry matter intake does not change).

Cold weather can also impact energy requirements. Cold temperatures cause the animal to use energy to maintain body temperature instead of using energy for growth. Factors such as wind speed, hide thickness, hair coat, and mud impact energy requirements through their effects on lower critical temperature. For example, muddy conditions raise the ambient temperature at which the animal will begin to be affected by cold stress.

Negative Associative Effects

If high rates of gain are desired, grain or other concentrates must be added to the ration to increase energy density in the diet. However, adding cereal grains to forage based rations can decrease the digestibility of the forages. This decrease in digestibility is due to fermentation of starch in the rumen, which can cause the ruminal pH to drop. The reduction in pH reduces forage digestibility. As a general guideline, up to 0.2% of body weight of supplemental cereal grain will not seriously impact forage digestion or forage intake. In order to achieve high rates of gain in a backgrounding operation, producers must accept a slight decrease in forage digestibility in exchange for the higher rates of gain that can be achieved by feeding cereal grains.

An alternative would be to replace grains with high-energy fibrous byproducts such as wheat midds, soyhulls, corn gluten feed, or sugar beet pulp to alleviate these negative associative effects. These products contain much less starch than cereal grains and do not impact fermentation of forages to the same degree as cereal grains.

Protein

Protein requirements vary with level of performance expected from the cattle. Cattle targeted for lower average daily gains have lower protein requirements than cattle fed for higher average daily gains. Table 1 lists the crude protein requirements for various classes of backgrounding cattle.

Cattle actually have a metabolizable protein (MP) requirement. Metabolizable protein is difficult to measure and is not reported on routine feed analysis, so Table 1 presents crude protein (CP) requirements rather than MP requirements. Briefly, MP is the protein absorbed at the small intestine and is available to meet the protein requirement of body tissues. It can be supplied by either microbial protein (produced when carbohydrates in feeds are fermented in the rumen) or by undegraded intake protein (UIP). Undegraded intake protein is also referred to as escape or bypass protein. Sources of protein which are high in UIP include blood meal, feather meal, distillers grains, heat-treated oilseed meals, or xylose-treated oilseed meals. Supplemental UIP is probably not needed in most backgrounding diets unless very high rates of gain are desired. Due to the nature of most backgrounding diets (blends of forages and concentrates), production of microbial protein is usually adequate to meet the MP requirements of the growing calf.

Ruminal microorganisms require degradable intake protein (DIP). DIP is protein used by the ruminal microorganisms to aid in digestion of fiber and starch. Good quality forages, sunflower meal, soybean meal, canola meal, and urea are all good sources of DIP. Meeting the needs of the ruminal microorganisms optimizes ruminal forage digestion.

In most cases, using typical feedstuffs, DIP and MP requirements can be met by feeding diets which are balanced for CP.

Table 1. Daily energy, protein, calcium and phosphorus requirements for backgrounding steers of various weights and average daily gains.

Animal Weight	Expected ADG	Expected DMI	NE_m	NE_g	TDN	CP	Ca	Phos
(lb)	(lb/day)	(lb)	(Mcal/lb)	(Mcal/lb)	(%)	(%)	(g)	(g)
300	0.5	9.0	0.48	0.23	52.5	9.5	11.2	7.1
300	1.0	9.0	0.54	0.28	56.0	11.3	18.2	9.1
300	1.5	9.0	0.59	0.33	59.5	12.9	24.0	11.2
300	2.0	9.0	0.64	0.38	63.5	14.6	29.9	12.8
300	2.5	9.0	0.70	0.44	67.5	16.3	37.0	14.8
300	3.0	9.0	0.77	0.49	72.0	18.0	43.1	17.0
300	3.5	9.0	0.86	0.57	78.5	20.3	49.0	19.0
400	0.5	12.0	0.48	0.23	52.5	8.9	11.9	7.8
400	1.0	12.0	0.54	0.28	56.0	10.2	18.1	9.8
400	1.5	12.0	0.59	0.33	59.5	11.4	24.1	11.8
400	2.0	12.0	0.64	0.38	63.5	12.7	30.3	13.8
400	2.5	12.0	0.70	0.44	67.5	13.9	35.1	16.2
400	3.0	12.0	0.77	0.49	72.0	15.2	41.1	17.8
400	3.5	12.0	0.86	0.57	78.5	16.9	47.0	18.8
500	0.5	15.0	0.48	0.23	52.5	8.5	13.1	9.3
500	1.0	15.0	0.54	0.28	56.0	9.5	19.2	11.0
500	1.5	15.0	0.59	0.33	59.5	10.4	23.7	12.8
500	2.0	15.0	0.64	0.38	63.5	11.4	28.8	15.0
500	2.5	15.0	0.70	0.44	67.5	12.4	35.0	15.9
500	3.0	15.0	0.77	0.49	72.0	13.4	40.0	17.8
500	3.5	15.0	0.86	0.57	78.5	14.7	45.1	19.8
600	0.5	18.0	0.48	0.23	52.5	8.2	13.8	11.3
600	1.0	18.0	0.54	0.28	56.0	9.0	19.2	11.9
600	1.5	18.0	0.59	0.33	59.5	9.7	24.3	13.9
600	2.0	18.0	0.64	0.38	63.5	10.5	28.7	15.8
600	2.5	18.0	0.70	0.44	67.5	11.3	34.4	16.8
600	3.0	18.0	0.77	0.49	72.0	12.1	38.0	19.0
600	3.5	18.0	0.86	0.57	78.5	13.2	43.2	19.8
700	0.5	21.0	0.48	0.23	52.5	7.9	14.7	11.9
700	1.0	21.0	0.54	0.28	56.0	8.6	20.1	14.1
700	1.5	21.0	0.59	0.33	59.5	9.2	24.2	14.8
700	2.0	21.0	0.64	0.38	63.5	9.8	29.1	17.0
700	2.5	21.0	0.70	0.44	67.5	10.5	32.7	18.0
700	3.0	21.0	0.77	0.49	72.0	11.1	36.8	18.8
700	3.5	21.0	0.86	0.57	78.5	12.0	41.3	20.7
800	0.5	24.0	0.48	0.23	52.5	7.7	16.3	14.0
800	1.0	24.0	0.54	0.28	56.0	8.3	19.8	14.9
800	1.5	24.0	0.59	0.33	59.5	8.8	24.2	16.4
800	2.0	24.0	0.64	0.38	63.5	9.3	28.5	17.8
800	2.5	24.0	0.70	0.44	67.5	9.8	31.6	19.0
800	3.0	24.0	0.77	0.49	72.0	10.4	36.1	19.9
800	3.5	24.0	0.86	0.57	78.5	11.1	39.4	21.0
900	0.5	27.0	0.48	0.23	52.5	7.6	16.9	15.2
900	1.0	27.0	0.54	0.28	56.0	8.0	20.7	16.2
900	1.5	27.0	0.59	0.33	59.5	8.5	25.5	17.0
900	2.0	27.0	0.64	0.38	63.5	8.9	28.2	19.4
900	2.5	27.0	0.70	0.44	67.5	9.3	30.7	19.8
900	3.0	27.0	0.77	0.49	72.0	9.8	35.5	20.7
900	3.5	27.0	0.86	0.57	78.5	10.4	38.3	22.0

Adapted from 'Nutrient Requirements of Beef Cattle'. 6th Ed. 1984. National Academy Press. Washington, DC.

Table 2. Nutrient content (dry matter basis) of feeds commonly used in backgrounding.

Feedstuff	DM	TDN	NE_m	NE_g	CP	DIP	UIP	ADF	Ca	P
	(%)	(%)	(Mcal/lb)	(Mcal/lb)	(%)	(% of CP)	(% of CP)	(%)	(%)	(%)
Alfalfa Hay, mid-bloom	90	57	0.56	0.30	16.0	80.0	20.0	35.0	1.35	0.22
Alfalfa Haylage, mid-bloom	35	57	0.56	0.30	16.0	80.0	20.0	35.0	1.35	0.20
Barley	89	83	0.93	0.64	12.0	80.0	20.0	7.0	0.05	0.37
Barley Hay, Dough Stage	86	58	0.56	0.31	8.0	75.0	25.0	34.0	0.19	0.29
Barley Haylage	37	60	0.60	0.34	11.9	75.0	25.0	34.0	0.52	0.29
Barley Malt Coproducts	92	73	0.75	0.47	16.0	65.0	35.0	18.0	0.23	0.79
Barley Screenings	89	77	0.79	0.53	11.6	70.0	30.0	11.0	0.35	0.32
Barley Straw	90	43	0.38	0.00	4.1	80.0	20.0	52.0	0.37	0.11
Field or Navy Beans	90	87	0.91	0.64	25.4	80.0	20.0	6.0	0.17	0.63
Pinto Beans	90	83	0.87	0.60	25.2	80.0	20.0	6.0	0.16	0.39
Beet Pulp, Wet	20	74	0.80	0.52	10.0	70.0	30.0	33.0	0.75	0.11
Beet Pulp, Dry	91	74	0.80	0.52	10.0	70.0	30.0	33.0	0.69	0.11
Canola Meal	82	69	0.73	0.45	41.0	70.0	30.0	17.0	0.70	1.20
Condensed Separator Byproduct	66	67	0.75	0.42	20.0	100.0	0.0	0.0	0.05	0.03
Corn Gluten Feed, Dry	88	86	0.98	0.67	18.6	80.0	20.0	12.7	0.02	1.10
Corn Gluten Feed, Wet	43	86	0.98	0.67	18.6	80.0	20.0	12.7	0.02	1.10
Corn Grain	86	90	1.02	0.70	9.5	40.0	60.0	3.3	0.02	0.31
Corn Screenings	88	83	0.92	0.62	9.0	40.0	60.0	4.3	0.04	0.41
Corn Silage	35	70	0.74	0.47	8.0	75.0	25.0	26.6	0.27	0.20
Corn Steep Liquor	54	90	1.02	0.70	47.0	100.0	0.0	0.0	0.06	1.10
Corn Stover	90	50	0.50	0.15	4.8	70.0	30.0	46.0	0.49	0.09
Crambe Meal (Mech. Extraction)	90	55	0.56	0.26	34.6	70.0	30.0	34.7	1.26	0.88
Dry Distillers Grains (Corn)	90	90	0.99	0.68	30.4	40.0	60.0	21.3	0.26	0.83
Fat	100	177	2.16	1.59	0.0	100.0	0.0	0.0	0.00	0.00
Grass Hay (Native, full bloom)	90	50	0.45	0.20	6.2	75.0	25.0	41.0	0.38	0.14
Grass Hay (Brome, mid-bloom)	90	53	0.50	0.25	8.0	80.0	20.0	37.0	0.29	0.28
Molasses	77	75	0.77	0.50	10.0	100.0	0.0	0.0	0.12	0.03
Oatlage	36	59	0.58	0.32	12.7	75.0	25.0	39.0	0.58	0.31
Oats	89	77	0.84	0.55	13.6	70.0	30.0	16.0	0.07	0.36
Oat Straw	90	47	0.45	0.09	4.5	70.0	30.0	50.0	0.27	0.10
Peas	90	87	0.91	0.64	24.0	80.0	20.0	7.0	0.12	0.46
Pigeon Grass Seed	84	62	0.63	0.36	14.0	80.0	20.0	32.0	0.20	0.38
Potatoes	23	82	0.91	0.61	7.6	70.0	30.0	3.0	0.05	0.24
Potato Silage	25	79	0.82	0.55	8.2	70.0	30.0	5.0	0.04	0.23
Potato Waste	13	82	0.91	0.61	9.9	70.0	30.0	8.5	0.11	0.26
Slough Hay	94	45	0.54	0.19	5.0	70.0	30.0	47.0	0.42	0.14
Sorghum-Sudan Hay	91	56	0.57	0.27	6.0	70.0	30.0	42.0	0.55	0.30
Sorghum-Sudan Silage	28	55	0.56	0.26	8.0	75.0	25.0	42.0	0.46	0.44
Soybean Hulls	91	78	0.81	0.54	12.0	70.0	30.0	45.0	0.45	0.17
Soybean Meal	89	84	0.94	0.64	49.0	70.0	30.0	10.0	0.33	0.71
Sunflower Hulls	89	34	0.32	0.00	5.3	70.0	30.0	54.0	0.37	0.12
Sunflower Meal	90	60	0.60	0.34	32.0	80.0	20.0	25.0	0.33	0.75
Sunflower Seeds (Oil)	94	121	0.87	0.60	17.9	80.0	20.0	39.0	0.18	0.56
Sunflower Silage	25	55	0.56	0.26	12.2	80.0	20.0	33.0	1.32	0.38
Sweetclover Hay	87	55	0.56	0.26	15.7	75.0	25.0	40.0	1.27	0.25
Wheat	89	88	0.99	0.68	14.0	80.0	20.0	8.0	0.06	0.41
Wheat Chaff	92	40	0.39	0.00	5.5	70.0	30.0	40.0	0.20	0.15
Wheat Middlings	90	83	0.87	0.59	19.1	80.0	20.0	11.0	0.16	1.01
Wheat Screenings	86	72	0.75	0.49	16.0	80.0	20.0	16.0	0.17	0.40
Wheat Straw	90	43	0.40	0.02	3.6	70.0	30.0	52.0	0.19	0.09

Estimating Requirements for DIP

- Diets which are largely based on good to high quality forages should contain 13 % of TDN intake as DIP. For example, if steers are fed 20 pounds of high quality grass hay (65% TDN), then 1.69 pound of DIP should be supplied in the diet (20 lbs DMI * 65% TDN = 13 lbs TDN intake; 13 lbs TDN * 13 % = 1.69 pounds DIP).
- Diets based on lower quality forages, straws, or other crop residues should contain 10% of TDN intake as DIP.
- Diets which are 70% concentrate or greater should contain 8.5% of TDN intake as DIP.

Minerals

Phosphorus: High forage backgrounding diets are deficient in phosphorus. It can be added as part of the protein supplement or in a high phosphorus mineral supplement (greater than 9% phosphorus). A mixture of 50% common white salt and 50% dicalcium phosphate offered free choice will supply adequate supplemental phosphorus. In general, byproducts of the grain milling industry (e.g., corn gluten feed, wheat middlings) are high in phosphorus. Sugar beet pulp is generally low in phosphorus.

Calcium: Calcium can become deficient in backgrounding rations which contain high levels of grain. In these cases, limestone or other calcium sources can be added to increase the calcium level. The calcium to phosphorus ratio should be at least 1.2:1 and preferably 2.0:1 or higher. Ratios below 1.2:1 can cause reduced performance and increased incidence of urinary calculi (water belly), reductions in dry matter intake, and poor performance. Including ammonium sulfate or ammonium chloride in the mineral package can also help alleviate problems associated with urinary calculi.

Potassium: Backgrounding diets should be formulated to contain at least 0.6% potassium. Forages, molasses, soybean meal, and distillers grains all contain high levels of potassium. Supplemental potassium is probably not necessary for backgrounding diets based largely on forages. In diets which contain high levels of grains, supplemental potassium in the form of potassium chloride or molasses-based supplements is warranted.

Sodium Chloride: Sodium chloride (common salt) should be supplied at 0.3% of dry matter intake. Common salt can either be fed free choice (mixed with the mineral package to limit intake) or be included as part of the supplement.

Trace Minerals

Trace minerals (TM) can be supplied in a TM salt package, fed as part of a supplement, or offered as a free choice mineral package.

Copper: In North Dakota, copper is the trace mineral producers should be most concerned about. Copper availability is lowered when diets are high in sulfur, iron, or molybdenum. In many areas of the state, feed analysis will show that copper levels in basal feedstuffs are adequate when compared to requirements. However, since copper can be tied up through interactions with iron, molybdenum, and sulfur, feeding levels above the requirement may be warranted. Supplemental copper intakes of 200 mg copper/head daily are recommended. Do not use copper oxide as the source of supplemental copper. The copper in copper oxide is unavailable. Copper sulfate, copper chloride, or organic sources of copper should be used instead.

Zinc: Zinc plays an important role in immunity, in addition, to being a component of many enzyme systems. The recommended level of zinc in diets for beef cattle is 30 mg/kg of dry diet (13.6 mg/pound of dry diet).

Vitamins

B Vitamins: Because of the nature of ruminal fermentation, B vitamins are generally not limiting in rations for beef cattle. Rumen microbes generally synthesize B vitamins in adequate quantities to meet cattle requirements). In some cases where diets are extremely high in sulfur, supplemental thiamin may be required to prevent cases of polioencephelomalacia (PEM). PEM is a neurological disorder characterized by recumbency, convulsions, and blindness. Diets containing high levels (greater than 50% of the diet; dry matter basis) of wet corn milling byproducts (wet or dry corn gluten feed) have been associated with increased incidence of PEM. Finishing diets containing molasses and urea have been implicated in cases of PEM as well.

Vitamin A: Supplemental vitamin A may not be necessary if calves are fed good quality, green hays that are less than one year old. Supplemental vitamin A may be necessary if diets are based on poor quality forages, straws, or hays more than one year old . Supplemental vitamin A should be fed at 10,000 to 15,000 IU per head daily. Injectable vitamin A can also be given at weaning.

Vitamin D: Supplemental vitamin D will be necessary if calves are housed indoors during the winter months. Sunlight acts on sterols found on the skin and converts them to vitamin D through a series of biochemical reactions. If calves are housed indoors in confinement buildings and shielded from sunlight, this reaction cannot occur. Sun-cured forages are a good source of vitamin D. In addition, most commercial supplements contain some vitamin D. Since vitamin D is synthesized by cattle exposed to sunlight, supplemental vitamin D is rarely required. The dietary requirement for vitamin D is 125 IU/pound of dry diet.

Water

Calves should always have access to adequate quantities of good quality clean water. In some areas of North Dakota, wells and other sources of drinking water can contain high levels of sulfates that may interfere with copper absorption and can contribute to increased incidence of PEM. In cases where copper deficiencies are suspected, analysis of the water source, in addition to feed analysis, is warranted.

Rules of Thumb for Estimating Dry Matter Intake

When it is not possible to measure intake or when no historical records exist to estimate dry matter intakes, the following guidelines can be used to estimate dry matter intakes.

- High Forage Backgrounding Diets (greater than 60% Roughage). Calves will consume 3.5% of initial body weight over the backgrounding period. For example, calves having an initial body weight of 500 pounds will be backgrounded for 120 days at 1.5 pounds ADG. These calves should consume an average of 17.5 pounds per head per day over the backgrounding period (500 pounds x 3.5% body weight = 17.5 pounds intake).
- High Concentrate Backgrounding Diets (greater than 60% concentrate). Calves will consume 3% of initial body weight over the backgrounding period. For example, calves with an initial body weight of 650 pounds will be backgrounded for 90 days at 2.5 pounds ADG. These calves should consume an average of 19.5 pounds per head per day over the backgrounding period (650 pounds x 3% body weight = 19.5 pounds intake).

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