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Low Cost Cow/Calf Program: The School – Part IX

In this issue of Dr. Dick Diven's (Agri-Concepts, Inc.) information we will look at the other macro-mineral (potassium, magnesium, sulfur, and salt) needs of the cow through the production year and determine the amount she would obtain from the rangeland grasses, smooth bromegrass hay, and 30% protein supplement.

Note: I learned this past November from Dave Pratt of the Ranching for Profit School that Dr. Dick Diven had lost his battle with cancer and passed away earlier in the year. May he rest in peace!

THE COW HERD

The cows have an average shrunk body weight (SBW) of 1200 pounds when in body condition score (BCS) 5.0. Thus their empty body weight (EBW) is 1021 pounds (1200 lb * 0.851). Calving season is 60 days; average calf birth weight 100 pounds; peak milk production at week 9 is 17.5 lb/day; calves weaned at eight months.

The production year scenarios we looked in Parts VI (Jan 2011) and VII (Jul 2011) were for a cow calving the first of Feb, Mar, Apr, May, or Jun with the provision of a 30% protein supplement when degradable intake protein (DIP) was insufficient. In addition, we looked at the same production scenarios but with the provision of smooth bromegrass hay instead of native range forage for the last month of gestation and the first three months of lactation if these occurred during the winter and early spring months.

Range Grass Potassium (K) Content

As grasses mature and no new tissue is developed potassium content declines due to the K cation leaching from the leaves. Once the plants go dormant and are subjected to weathering leaching of the K^+ intensifies. As a result grasses are highest in potassium in late spring and lowest in early spring prior to green up. This was the case for the grasses from the pastures of the five Johnson County, Wyoming ranches sampled in 2002, 2003, and 2004 with their potassium content lowest in Mar and highest in May (Table 1).

Beef Cow Potassium Needs

Dr. Diven stated that the K requirement by all classes of cattle is the same; **0.016** lb K per Mcal of NEm consumed. Table 1 shows the amounts of potassium (lb/day) a 1200 lb beef cow in BCS 5.5 at time of calving would consume from the range grasses and 30% protein supplement and how much she would require each month of the year based on the Mcal NEm she consumed.

The National Research Council ([NRC] 1996) suggests that growing and finishing cattle and gestating cows require a diet that contains 0.60% K and lactating cows a diet with 0.70% K. These amounts may be too low to meet the rumen microbes' potassium needs. Because rumen microbes convert the energy and much of the protein in the forage into a form the animal can use you want to ensure their nutrient needs are met. Thus slightly more potassium in the diet may well be warranted. Basically a diet with about 1.0% K should suffice; i.e. for every pound of dry forage and feed consumed 0.16 ounces of K are needed.

The range grasses contained enough potassium to meet the cows' needs May through Aug (Table 1). The 30% protein supplement contained 0.8% K (dry matter basis; 0.9% as is basis) so it would help offset the deficiency in the grasses in the months it is provided but not enough to meet the cow's potassium needs.

For the months the range grasses and protein supplement do not provide enough potassium to the cows a supplement would be needed. To determine how much is needed divide the amount of potassium lacking in the diet (Table 1: Balance column) by the %K in the supplement. If potassium bicarbonate (39% K) is used as that supplement each cow would need to be provided 0.4 lb/day in Feb (0.15 lb ÷ 0.39). This supplement may not be readily available at your local feed store but we'll use it for this exercise as it contains no other minerals keeping things as simple as possible. After the needed amounts of all minerals are determined they would be provided in a custom mineral mix.

As noted above a supplement would appear to be needed Feb – Apr and probably Nov – Jan as well. Although there appears to be a shortage of potassium in the range grasses in Sep and Oct a supplement is probably not warranted as rangeland forbs could provide an adequate amount. Forbs from the Big Horn Mountains sampled in Aug 2010 contained an average of a little more than 1% K whereas upland grasses contained an average of 0.7%.

Now we'll look at how much potassium smooth bromegrass hay would provide the cows' and if a supplement would be needed. Late bloom to mature smooth brome hay from the hay trials in Johnson and Sheridan Counties contained around 2.5% K. Based on this level of potassium, smooth brome hay would provide the Feb calving cows an adequate amount of potassium in the months it is fed (Table 2) but a supplement would need to be provided the cows during the months of Sep – Dec if hay was not fed then. However, as noted for the non-hayed cows, a supplement may not be warranted in Sep and Oct due to the potassium content of available forbs if they are present and palatable.

Table 1: Range grass potassium (K) content, amount consumed from the grass and protein supplement, amount required by a 1200 lb shrunk body weight cow; body condition score 5.5 at calving in Feb, calf weaned in Oct; and amount of potassium bicarbonate ($KHCO_3$).

	K (%)		K Consumed (lb/day)[2]			K Required	Balance	$KHCO_3$
Mon	**Grass**	**Protein**	**Grass**	**Protein**	**Total**	**(lb/day)[3]**	**(lb/day)**	**(lb/day)[4]**
Feb	0.30	0.80	0.079	0.023	0.102	0.250	-0.147	0.38
Mar	0.25	0.80	0.066	0.026	0.092	0.246	-0.155	0.40
Apr	0.25	0.80	0.066	0.015	0.081	0.241	-0.160	0.41
May[1]	2.00		0.648		0.648	0.378	0.270	
Jun	1.75		0.567		0.567	0.337	0.230	
Jul	1.50		0.486		0.486	0.337	0.149	
Aug	1.30		0.359		0.359	0.283	0.076	
Sep	0.90		0.248		0.248	0.278	-0.030	0.08
Oct	0.80		0.192		0.192	0.223	-0.031	0.08
Nov	0.50	0.80	0.108	0.013	0.121	0.213	-0.092	0.24
Dec	0.45	0.80	0.097	0.015	0.112	0.210	-0.098	0.25
Jan	0.35	0.80	0.076	0.017	0.093	0.207	-0.115	0.29

[1] *Beginning of breeding period (approximately 83 days after calving)*

[2] K consumed from range grasses and protein supplement: lb Dry Matter Intake * (% K/100)

Ex. Feb: Table 1, Part VII (July 2011) 26.4 lb grass * (0.30/100) = 26.4 * 0.003 = 0.08 lb K; (3.3 lb protein * 89% dry matter) * (0.8/100) = 2.9 * 0.008 = 0.023 lb K

[3] K required: Mcal NEm consumed from range grasses and protein supplement * 0.016

Ex. Feb: Table 3, Part VII (July 2011) 15.6 Mcal * 0.016 = 0.25 lb K

[4] $KHCO_3$ (Potassium bicarbonate contains 39% K): Negative balances ÷ (39%/100) = lb needed

Ex. Feb: 0.15 ÷ (39%/100) = 0.12 ÷ 0.39 = 0.38 lb $KHCO_3$

Does later calving affect the amount of potassium that needs to be supplemented? Somewhat for cows on rangeland year round and definitely so for those fed smooth brome hay. The cows on rangeland required a total of 64, 63, 62, 61, or 59 pounds of the $KHCO_3$ supplement when calving in Feb, Mar, Apr, May, or Jun, respectively. For those that were fed hay in the winter and early spring the total annual amount of the $KHCO_3$ supplement required ranged from 15 lb for the Feb calving cows to 61 lb for the Jun calving ones. As with phosphorus the slight difference in cow potassium needs among the calving scenarios for the cows on rangeland year round was due to changes in cow size over the year and resultant NEm (M) requirement. The reason for the large discrepancy in the amount of the supplement needed by the cows fed hay was due to the amount of potassium in the smooth brome hay. For each month calving season was delayed there was one less month that the hay was fed and thus the supplement was needed to make up for the loss. When cows calve has little effect on their total potassium needs. Although feeding hay instead of grazing rangeland may be more costly in itself, it reduces the amount of supplement needed. The question is which is more expensive the hay or the supplement.

Range Grass Magnesium (Mg) Content

Grass magnesium content is highest in the early vegetative stage, declines slightly as the plants mature, and during dormancy declines significantly. Thus, the magnesium content of NE WY range grasses was lowest in Mar and highest in May (Table 3).

Table 2: Range grass or smooth bromegrass hay potassium (K) content, amount consumed from the grass or hay and protein supplement, amount required by a 1200 lb shrunk body weight cow; body condition score 5.5 at calving in Feb, calf weaned in Oct; and amount of potassium bicarbonate ($KHCO_3$).

	K (%)		K Consumed (lb/day)[2]				K Required	Balance	$KHCO_3$
Mon	Grass	Hay	Grass	Hay	Protein	Total	(lb/day)[3]	(lb/day)	(lb/day)[4]
Feb		2.50		0.660		0.660	0.253	0.407	
Mar		2.50		0.660		0.660	0.253	0.407	
Apr		2.50		0.660		0.660	0.253	0.407	
May[1]	2.00		0.648			0.648	0.378	0.270	
Jun	1.75		0.567			0.567	0.337	0.230	
Jul	1.50		0.486			0.486	0.337	0.149	
Aug	1.30		0.359			0.359	0.278	0.076	
Sep	0.90		0.248			0.248	0.278	-0.030	0.08
Oct	0.80		0.192			0.192	0.223	-0.031	0.08
Nov	0.50		0.090			0.090	0.156	-0.066	0.17
Dec	0.45		0.081			0.081	0.150	-0.069	0.18
Jan		2.50		0.540		0.540	0.207	0.330	

[1]*Beginning of breeding period (approximately 83 days after calving)*

[2]K consumed from range grasses or smooth bromegrass hay: lb Dry Matter Intake * (% K/100)

Ex. Feb: Table 5, Part VII (July 2011) 26.4 hay * (2.50/100) = 26.4 * 0.025 = 0.66 lb K

Note: No protein supplement provided as smooth bromegrass hay provided an adequate amount to meet the cows' needs, although protein was provided for Mar – Jun calving cows.

[3]K required: Mcal NEm consumed from range grasses or smooth bromegrass hay * 0.016

Ex. Feb: Table 5, Part VII (July 2011) 15.8 Mcal * 0.016 = 0.25 lb K

[4]$KHCO_3$ (Potassium bicarbonate contains 39% K): Negative balances ÷ (39%/100) = lb needed

Ex. Sep: 0.03 ÷ (39%/100) = 0.03 ÷ 0.39 = 0.08 lb $KHCO_3$

Beef Cow Magnesium Needs

Like potassium the amount of magnesium required by all classes of cattle is the same; **0.003** lb Mg per Mcal of NEm consumed. Table 3 shows the amounts of magnesium (lb/day) a 1200 lb beef cow in BCS 5.5 at time of calving would consume from the range grasses and how much she required each month of the year based on the Mcal NEm she consumed.

The NRC (1996) suggests that the amount of magnesium in the diets of growing and finishing cattle should be 0.10%, gestating cows 0.12%, and cows in early lactation 0.20%. The 0.003 lb of Mg per Mcal NEm consumed results in about 0.20% Mg in the diet of our beef cows.

The range grasses did not contain an adequate amount of magnesium to meet the cows' needs in any month (Table 3). Range grasses of the Shortgrass Steppe in Colorado also were found to be lacking in magnesium. Thus, grasses of the semi-arid and arid rangelands of the West may all be lacking in magnesium. The 30% protein supplement did not contain any magnesium so would not help offset the deficiency in the grasses. A magnesium supplement would need to be provided the cows year round. The amount of supplement needed is determined by dividing the amount of magnesium lacking in the diet (Table 3: Balance column) by the %Mg in the supplement. For example if magnesium oxide (56% Mg) is the supplement, each cow will need 0.06 lb/day in Feb (0.034 lb ÷ 0.56).

Although magnesium oxide is the most common form of supplemental magnesium it has a bitter taste and livestock are often unwilling to consume it at recommended levels. To overcome this it should be provided to cattle mixed with a grain or oilseed supplement. Research has found that free-choice magnesium oxide consumption by grazing cattle was adequate when mixed in a 1:1:1 ratio with trace mineralized salt and either corn, alfalfa meal, dry cane molasses, or cottonseed meal. Again a custom mineral mix is the objective of this program. Magnesium oxide also contains 100 ppm of manganese, a micro nutrient, so when we get to discussion of it we will have to take this into account.

Table 3: Range grass magnesium (Mg) content, amount consumed from the grass, amount required by a 1200 lb shrunk body weight cow; body condition score 5.5 at calving in Feb, calf weaned in Oct; and amount of magnesium oxide (MgO).

Mon	Mg (%) Grass	Mg Consumed (lb/day)[2]	Mg Required (lb/day)[3]	Balance (lb/day)	MgO (lb/day)[4]
Feb	0.05	0.013	0.047	-0.034	0.06
Mar	0.05	0.013	0.046	-0.033	0.06
Apr	0.05	0.013	0.045	-0.032	0.06
May[1]	0.14	0.045	0.071	-0.026	0.05
Jun	0.13	0.042	0.063	-0.021	0.04
Jul	0.11	0.036	0.063	-0.027	0.05
Aug	0.11	0.030	0.053	-0.023	0.04
Sep	0.11	0.030	0.052	-0.022	0.04
Oct	0.10	0.024	0.042	-0.018	0.03
Nov	0.08	0.017	0.040	-0.023	0.04
Dec	0.07	0.015	0.039	-0.024	0.04
Jan	0.06	0.013	0.039	-0.026	0.05

[1]*Beginning of breeding period (approximately 83 days after calving)*
[2]Mg consumed from range grasses: lb Dry Matter Intake * (% Mg/100)
Ex. Feb: Table 1, Part VII (July 2011) 26.4 lb grass * (0.05/100) = 26.4 * 0.0005 = 0.013 lb Mg
[3]Mg required: Mcal NEm consumed from range grasses and supplement * 0.003
Ex. Feb: Table 3, Part VII (July 2011) 15.6 Mcal * 0.003 = 0.047 lb Mg
[4]MgO (Magnesium Oxide contains 56% Mg): Negative balances ÷ (56%/100) = lb needed. Ex. Feb: 0.034 ÷ (56%/100) = 0.034 ÷ 0.56 = 0.06 lb MgO

The amount of magnesium smooth brome hay would provide the cows' may be variable. The magnesium content of late bloom to mature smooth brome hay from the hay trials conducted in Johnson and Sheridan Counties ranged from 0.09% to 0.21% with an average of 0.16%. The magnesium amount listed in the Feed Library (NRC 1996) for mature smooth brome hay was 0.12%; and for pre-bloom and mid-bloom hay it was listed as containing 0.09% and 0.10%, respectively. No value was listed for late bloom smooth brome hay but it is probably around 0.11%.

If the smooth brome hay contained at least 0.20% Mg it would provide the cows an adequate amount of magnesium in the months it is fed. However, because we cannot be sure it contains that much (reason for quality analysis) we'll go with the average amount from the hay trials of 0.16%. Thus, as with the cows grazing rangeland year round we will need to supplement these cows with magnesium year round as well.

Later calving did not affect the amount of magnesium that needed to be supplemented for the cows on rangeland year round and only slightly so for those fed smooth brome hay. The cows on rangeland year round required a total of 18 lb of the magnesium oxide no matter when they calved and for those that were fed hay in the winter and early spring the total annual amount ranged from 10 lb for the Feb calving cows to 12 lb for the May and Jun calving ones. The slight difference in the amount of magnesium oxide supplement needed by the cows fed hay was due to one less month of hay for every month calving was delayed.

Table 4: Range grass or smooth brome hay magnesium (Mg) content, amount consumed from the grass or hay, amount required by a 1200 lb shrunk body weight cow; body condition score 5.5 at calving in Feb, calf weaned in Oct; and amount of magnesium oxide.

	Mg (%)		Mg Consumed (lb/day)[2]			Mg Required (lb/day)[3]	Balance (lb/day)	MgO[4] (lb/day)
Mon	Grass	Hay	Grass	Hay	Total			
Feb		0.16		0.042	0.042	0.047	-0.005	0.009
Mar		0.16		0.042	0.042	0.047	-0.005	0.009
Apr		0.16		0.042	0.042	0.047	-0.005	0.009
May[1]	0.14		0.045		0.045	0.071	-0.026	0.046
Jun	0.13		0.042		0.042	0.063	-0.021	0.038
Jul	0.11		0.036		0.036	0.063	-0.027	0.049
Aug	0.11		0.030		0.030	0.053	-0.023	0.040
Sep	0.11		0.030		0.030	0.052	-0.022	0.039
Oct	0.10		0.024		0.024	0.042	-0.018	0.032
Nov	0.08		0.014		0.014	0.029	-0.015	0.026
Dec	0.07		0.013		0.013	0.028	-0.015	0.028
Jan		0.16		0.035	0.035	0.039	-0.004	0.008

[1]*Beginning of breeding period (approximately 83 days after calving)*

[2]Mg consumed from range grasses or smooth brome hay: lb Dry Matter Intake * (% Mg/100)
Ex. Feb: Table 5, Part VII (July 2011) 26.4 hay * (0.16/100) = 26.4 * 0.016 = 0.42 lb Mg

[3]Mg required: Mcal NEm consumed from range grasses or smooth bromegrass hay * 0.003
Ex. Feb: Table 5, Part VII (July 2011) 15.8 Mcal * 0.003 = 0.047 lb Mg

[4]MgO (Magnesium Oxide contains 56% Mg): Negative balances ÷ (56%/100) = lb needed
Ex. Feb: 0.005 ÷ (56%/100) = 0.005 ÷ 0.56 = 0.009 lb MgO

Rangeland Grass Sulfur (S) Content

As with magnesium, the sulfur content of range grasses is highest in the vegetative stage and declines slightly as the plants mature and more so when dormant and weathering. The sulfur content of the range grasses was lowest in March and highest in May (Table 5).

Beef Cow Sulfur Needs

The recommended amount of sulfur in the diet of all classes of cattle is **0.15%** (NRC 1996). Dr. Diven does not suggest an amount but points out that sulfur is a component of protein and would need to be supplemented if urea was provided as a degradable protein source. The rumen microbes will convert the urea to microbial protein which does contain sulfur but urea does not so sulfur needs to be fed to ensure the microbes' needs are met.

The amount of sulfur to feed is determined by the ratio of urea to inorganic sulfur in the supplement. For every unit of urea fed **0.03** units of sulfur need to be provided. Dr. Diven states that sodium and calcium sulfates are good sources of sulfur whereas elemental sulfur is sort of OK. He provides the following example: *Calcium sulfate, dihydrate ($CaSO_4 \cdot 2H_2O$), i.e. Gypsum, contains 18.6% S and 23.3% Ca. For every unit of urea fed 0.16 units of gypsum should be provided (0.03 ÷ 0.186).*

Although Dr. Diven was not concerned about sulfur in the diet of cattle unless they were supplemented with urea, we'll go through the same exercise we have for potassium and magnesium using 0.15% S in the diet suggested by the NRC (1996).

The sulfur content of the range grasses was below 0.15% during the dormant season (Nov – Apr) and the protein supplement did not contain any sulfur (Table 5). Thus, the provision of gypsum might be warranted during those months, especially if the cow was in lactation. This was the case no matter what month the cows calved in.

Table 5: Range grass sulfur (S) content, amounts consumed from the grass, amount required by a 1200 lb shrunk body weight cow; body condition score 5.5 at calving in Feb, calf weaned in Oct; and amount of calcium sulfate, dihydrate (gypsum).

Mon	S (%) Grass	S Consumed (lb/day)[2]	S Required (lb/day)[3]	Balance (lb/day)	Gypsum (lb/day)[4]
Feb	0.10	0.026	0.040	-0.014	0.08
Mar	0.09	0.024	0.040	-0.016	0.09
Apr	0.09	0.024	0.040	-0.016	0.09
May[1]	0.22	0.071	0.049	0.022	
Jun	0.18	0.058	0.049	0.009	
Jul	0.17	0.055	0.049	0.006	
Aug	0.16	0.044	0.041	0.003	
Sep	0.15	0.041	0.041	0.000	
Oct	0.15	0.036	0.036	0.000	
Nov	0.14	0.030	0.032	-0.002	0.01
Dec	0.12	0.026	0.032	-0.006	0.03
Jan	0.11	0.024	0.032	-0.008	0.04

[1]*Beginning of breeding period (approximately 83 days after calving)*

[2]S consumed from range grasses and protein supplement: lb Dry Matter Intake * (% S/100). Ex. Feb: Table 1, Part VII (July 2011) 26.4 lb grass * (0.10/100) = 26.4 * 0.001 = 0.026 S

[3]S required: Lb Dry matter consumed from range grasses * (0.15% /100)
Ex. Feb: Table 1, Part VII (July 2011) 26.4 lb grass * (0.15/100) = 26.4 * 0.0015 = 0.04 lb S

[4]Gypsum (contains 18.6% S): Negative balances ÷ (18.6%/100) = lb needed
Ex. Feb: 0.014 ÷ (18.6%/100) = 0.014 ÷ 0.186 = 0.08 lb gypsum

Late bloom to mature smooth brome hay from the hay trials contained 0.15% S or better with an average of 0.20%. Based on this, in the months it is provided the cows in lieu of them grazing rangeland they should obtain an adequate amount of sulfur (Table 6). Among the calving scenarios, the winter/early spring months that the smooth brome hay was not fed are the only times that there was a slight sulfur deficiency but probably not enough to warrant furnishing the gypsum supplement.

Table 6: Range grass or smooth bromegrass hay sulfur (S) content, amount consumed from the grass or hay, amount required by a 1200 lb shrunk body weight cow; body condition score 5.5 at calving in Feb, calf weaned in Oct; and amount of gypsum.

	S (%)		S Consumed (lb/day)[2]			S Required	Balance	Gypsum
Mon	Grass	Hay	Grass	Hay	Total	(lb/day)[3]	(lb/day)	(lb/day)[4]
Feb		0.20		0.053	0.053	0.040	0.013	
Mar		0.20		0.053	0.053	0.040	0.013	
Apr		0.20		0.053	0.053	0.040	0.013	
May[1]	0.22		0.071		0.071	0.049	0.022	
Jun	0.18		0.058		0.058	0.049	0.009	
Jul	0.17		0.055		0.055	0.049	0.006	
Aug	0.16		0.044		0.044	0.041	0.003	
Sep	0.15		0.041		0.041	0.041	0.000	
Oct	0.15		0.036		0.036	0.036	0.000	
Nov	0.14		0.025		0.025	0.027	-0.002	0.011
Dec	0.12		0.022		0.022	0.027	-0.005	0.027
Jan		0.20		0.043	0.043	0.032	0.011	

[1]*Beginning of breeding period (approximately 83 days after calving)*
[2]S consumed from range grasses or smooth brome hay: lb Dry Matter Intake * (% S/100)
Ex. Feb: Table 1, Part VII (July 2011) 26.4 lb hay * (0.20/100) = 26.4 * 0.002 = 0.053 lb S
[3]S required: Lb Dry matter consumed from range grasses or smooth bromegrass hay * (0.15% /100)
Ex. Feb: Table 1, Part VII (July 2011) 26.4 lb hay * (0.15/100) = 26.4 * 0.0015 = 0.04 lb S
[4]Gypsum (contains 18.6% S): Negative balances ÷ (18.6%/100) = lb needed
Ex. Nov: 0.002 ÷ (18.6%/100) = 0.002 ÷ 0.186 = 0.011 lb gypsum

Salt (Sodium and Chlorine)

As you are well aware most plants contain little, if any, sodium (Na) – although there are a few exceptions – so it needs to be provided to livestock and to ourselves for that matter. The sodium requirement of cattle can be estimated by multiplying Mcal NEm consumed by the constant **0.0027** to obtain lb/day Na needed. The recommended amount by the NRC (1996) for beef cows is 0.10% of their diet if lactating, 0.06 – 0.08% otherwise.

Salt (NaCl) is the most common source of supplemental sodium and with the willingness of cattle to consume it from salt blocks do we need to concern ourselves with determining how much sodium we should be providing them? If we are going to furnish a complete supplement, Yes! Dr. Diven points out that in controlled feeding trials where the sodium requirement was more than satisfied in a complete mixed diet, cattle still consumed a considerable amount of block or loose free-choice salt. Dr. Diven indicated that complete supplements for cattle on forage diets should include salt based on the livestock's sodium requirement and free choice salt should be avoided. When salt is available free-choice, consumption of the complete supplement will be reduced and the amount of the other minerals consumed will be less than required.

What about chlorine (Cl)? Requirements for beef cattle are not known and deficiencies have not been demonstrated but it is needed. Currently it is believed that as sodium requirements are met with salt, chlorine needs are also satisfied.

The grasses from the five Johnson County ranches were not analyzed for sodium content but the grasses in the hay trials were in a couple of years. The average sodium content of the grass hays ranged from none to 0.13%, although most averaged less the 0.10%. The sodium content of the 30% protein supplement was 1.0%.

As with the other macro-minerals, except sulfur, Dr. Diven's sodium recommendation results in slightly more sodium being needed by the cow than if the NRC (1996) recommendation is followed. For example, the Feb calving cow on rangeland would consume 15.6 Mcal of NEm from the range grasses and protein supplement, thus would require 0.035 lb of sodium (15.6 Mcal * 0.00227). Her dry matter consumption would be 26.4 lb of range grass and 2.9 lb of the supplement for a total of 29.3 lb. Because she is lactating she would require about 0.03 lb of sodium based on the NRC recommendation (29.3 lb * 0.001). The difference is small and providing the higher amount in a custom mineral mix would ensure that the cows obtained an adequate amount of sodium, especially if free-choice salt is not provided as Dr. Diven recommends. Remember, salt is often included in mineral mixes so that the animals are encouraged to consume them.

Table 7 shows the amount of sodium the Feb calving cow would obtain from the protein supplement and the amount she would require based on Mcal of NEm consumed. The amount of salt needed to satisfy her sodium requirement is also shown. The assumption is the range grasses provided little to no sodium.

The annual amount of salt to satisfy the cow's sodium requirement when on rangeland year round ranged from 25 lb if she calved in Feb to 31 lb if she calved in Jun. The difference is due to the protein supplement being furnished a month less for every month calving is delayed. If we assume the smooth brome hay contained 0.024% Na (grass hay trials) the annual salt requirement for the cow ranged from 33 lb if she calved in Feb to 26 lb if she calved in Jun. The lessening amount for every month calving is delayed is due to the smooth brome hay being replaced by range grass and the protein supplement.

Summary for K, Mg, S, and Na

When cows calved if on rangeland year round had little effect on the supplemental amount of potassium, magnesium, and sulfur they needed. It did result in a slight increase in the amount of salt needed as calving was delayed due to less of the protein supplement being provided based on the amount of salt it contained.

If the cows were fed smooth bromegrass hay in lieu of grazing rangeland the amount of supplemental potassium and sulfur increased for every month calving was delayed due to less of the hay being fed. The amount of supplemental magnesium needed also increased as calving was delayed but only slightly. Whereas, the amount of salt needed by the cow decreased slightly as calving was delayed.

After we have looked at the micro-minerals in the next installment of this series we'll put some fed costs to the calving scenarios and determine which might be the least costly.

Table 7: Amount of sodium (Na) consumed from the 30% protein supplement if on rangeland year round or the smooth brome hay if not, the amount required by a 1200 lb shrunk body weight cow; body condition score 5.5 at calving in Feb, calf weaned in Oct for both situations; and amount of salt for both.

Mon	30% Protein Supplement[2] Na (lb/day)			Salt[3] (lb/day)	Smooth Bromegrass Hay[4] Na (lb/day)			Salt[3] (lb/day)
	Consumed	Required	Balance		Consumed	Required	Balance	
Feb	0.029	0.035	-0.006	0.015	0.006	0.035	-0.029	0.074
Mar	0.032	0.035	-0.003	0.008	0.006	0.035	-0.029	0.074
Apr	0.018	0.034	-0.016	0.040	0.006	0.035	-0.029	0.074
May[1]		0.054	-0.054	0.137		0.054	-0.054	0.137
Jun		0.048	-0.048	0.122		0.048	-0.048	0.122
Jul		0.048	-0.048	0.122		0.048	-0.048	0.122
Aug		0.040	-0.040	0.102		0.040	-0.040	0.102
Sep		0.040	-0.040	0.100		0.040	-0.040	0.100
Oct		0.032	-0.032	0.080		0.032	-0.032	0.080
Nov	0.017	0.030	-0.014	0.036		0.022	-0.022	0.056
Dec	0.019	0.030	-0.011	0.028		0.021	-0.021	0.054
Jan	0.021	0.029	-0.008	0.020	0.005	0.029	-0.024	0.062

[1]*Beginning of breeding period (approximately 83 days after calving)*

[2]Na consumed from the protein supplement: lb Dry Matter Intake * (% Na/100)

Ex. Feb: Table 1, Part VII (July 2011) (3.3 lb protein * 89% Dry Matter) * (1% Na/100) = 2.9 * 0.01 = 0.003 lb Na

Na required: Mcal NEm consumed from protein supplement * 0.00227

Ex. Feb: Table 3, Part VII (July 2011) 15.6 Mcal * 0.00227 = 0.035 lb Na

[3]Salt (contains 39.3% Na): Negative balances ÷ (39.3%/100) = lb needed

Ex. Feb (protein): 0.006 ÷ (39.3%/100) = 0.006 ÷ 0.393 = 0.015 lb salt

Ex. Feb (hay): 0.2029 ÷ 0.393 = 0.074 lb salt

[4]Na consumed from the smooth bromegrass hay: lb Dry Matter Intake * (% Na/100)

Ex. Feb: Table 5, Part VII (July 2011) 26.4 hay * (0.024%/100) = 26.4 * 0.00024 = 0.006 lb Na

Na required: Mcal NEm consumed from smooth bromegrass hay * 0.00227

Ex. Feb: Table 3, Part VII (July 2011) 15.6 Mcal * 0.00227 = 0.035 lb Na

References

[NRC] National Research Council. 1996 (Update 2000). Nutrient Requirements of Beef Cattle (7th revised edition). Washington, DC, USA: National Academy Press. 234 p.
Note: Appendix Table 1 – Feed Library pp. 192 – 203.