

Cattle Grower Ration Balancing Spreadsheet

User's Guide



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Purpose

The Cattle Grower Ration Balancing (GRB) spreadsheet was designed for balancing rations for growing and finishing cattle. The spreadsheet program is based on equations developed by the National Research Council (NRC) and published in the 1996 and 2000 Nutrient Requirements for Beef Cattle. Users should not expect animals to always perform exactly as predicted by the spreadsheet. Various factors such as actual versus estimated quality of ingredients, intake, weather, calf genetics and health all play a role in how well an animal gains on a particular diet.

Using the Spreadsheet

A working version of Microsoft Excel is required to run this spreadsheet program. When loading the program a screen, will prompt that the spreadsheet contains macros. Macros must be ENABLED for the spreadsheet to function correctly.

To enable macros, go to the Tools menu and click Options. Select the Security tab and choose Macro Security. On the Security Level tab, choose Medium. Click OK and then OK again.

General Layout

The GRB spreadsheet is composed of four sheets:

- 1) **Calf Info** (red tab)
- 2) **Ration Formulation** (orange tab)
- 3) **Feed List** (green tab)
- 4) **Feed Blend** (blue tab)

Cells that can be modified are **blue**. All other cells are protected from modification.

Calf Info (Figure 1)

The **Calf Info** page provides input for producer information, calf type and desired growth rate. Weights entered into this program are assumed to be unshrunk weights; therefore, adjustments to body weight are made by the spreadsheet to estimate shrunk and empty body weight necessary to calculate requirements and estimate performance. Likewise, estimates of requirements and intake are calculated under the assumption that neither ionophores nor implants are being used. Using these management options will improve performance of cattle on a given diet.

The design of the **Calf Info** page is based on the concept that cattle producers will have an estimated start and completion date for a set of cattle. Entering the estimated mature body

weight and percent of mature body weight targets become a necessity to determine the desired average daily gain. This design was chosen to complement heifer and bull development programs where target rates of gain and periodic weighing and feed adjustment can be accommodated.

Features

Input	Cell(s)	Cell(s) can be modified?	Description
Producer Information	C2 to C7	Yes	Enter Name, Address, City, State, Zip, Phone
Number of Head	D9	Yes	Enter 1 or Actual number of head.
Sex	D10	Yes	Required to adjust requirements for sex of calf. Choose one.
Start Date	D11	Yes	Necessary to calculate desired rate of gain. Enter start date.
Start Weight	D12	Yes	Necessary to calculate desired rate of gain. Enter weight in pounds.
Start Body Condition	D13	Yes	Necessary to adjust maintenance requirements. This cell contains an attached note with the condition score values and a description of the scores. Enter body condition score.
Calf Breed Type	D15	Yes	Necessary to adjust maintenance requirements for breed type. Brahman-influenced breeds' energy maintenance requirements are adjusted downward, and maternal breeds are adjusted upward. Choose one.
Estimated Mature Weight	D17	Yes	Required for calculating daily gain. Enter weight in pounds.
Target % of Mature Weight	D18	Yes	Required for calculating daily gain. Replacement heifers are generally fed to achieve 65% of expected mature body weight by the start of the breeding season.
Target Ending Weight	D19	No	This value is calculated from cell D17 and D18. To adjust target ending weight, make sure estimated mature weight (D17) is within reason and adjust the target percent (D18) as needed to achieve the desired target ending weight.
Target Ending Date	D20	Yes	Enter the target ending date to complete the necessary information to estimate the desired rate of gain.
Estimated Feeding Days	D22	No	The difference between the ending (D20) and starting date (D11).
Required Rate of Gain	D23	No	The desired rate of gain based on the difference between the target ending weight (D19) and starting weight (D12) and the number of days in the feeding period (D22).
Projected Weights At:	B27 to C36	No	This is an estimation of weights at future dates based on the desired rate of gain.
Average Feeding Period Age and Weight	None	None	This section uses the average age and weight to calculate requirements based on an interval within the feeding period (ex. Average age and weight expectations during the first 60 days of a 120-day feeding period) or based on the entire feeding period (ex. Average over 120 days). Formulating rations based on incremental periods allows for a fine tuned feeding program because protein requirements as a percent of the diet are reduced as calves mature.
Calf Age	D39	Yes	Enter the average age in months for the group during the feeding period. Formulas for intake differ for weanling and yearling cattle; therefore, age estimate is important for accurate ration formulation.
Start Period Weight	D40	Yes	Enter the start weight for the feeding period.
End Period Weight	D41	Yes	Enter the ending weight for the feeding period.
Average Period Weight	D42	No	The calculated average weight in which formulas for calculating requirements will be based on.

Note: Cells in blue are modified by the user.

Ration Formulation (Figure 2)

The **Ration Formulation** sheet is where feedstuffs are entered and adjusted to balance the ration. Rations are formulated on an as-fed basis. The user may choose to balance rations using a variety of methods including entering feeds on a percent of intake or percent of diet, pounds per cwt or pounds per ton, or as pounds of intake. These methods of ration balancing will be addressed later. The **Ration Formulation** sheet has five components:

Feed Reference No. Quick Finder	Allows the user to lookup feed codes without switching between the Feed Formulation and Feeds List sheets.
Feedstuff Entry Cells	This section is where the user enters feed reference codes, feed percentages or amounts, and price of selected ingredients.
Dry Matter Intake	These cells show the NRC predicted dry matter intake and allow the user to adjust the predicted intake if necessary.
Nutrient Profile	These cells present the estimated dry matter nutrient profile based on the entered feed ingredients and amounts.
Performance Indicators	These cells present the desired and estimated rates of gain, estimates of feed conversion, and cost of gain.

Feedstuff Entry

Input	Cell	Cell(s) can be modified?	Description
Feed No	A7 to A21	Yes	Enter the Feed Number. Up to 15 feeds may be entered from the feed list.
Ingredient Name	B7 to B21	No	Corresponding name for the Feed Number.
As-Fed Diet Composition	C7 to C21	Yes	Enter the composition of each ingredient. See Methods of Entering As-Fed Diet Composition below.
\$/cwt As-Fed	D7 to D21	Yes	Enter the \$/cwt of each feed ingredient if prices are available. Adjusting feed ingredients based on price may help select the ingredient that results in a more economical cost of gain (Performance Indicator in cell C35).
As-Fed Total	C22	No	Cumulative total of As-Fed Diet Composition.
Dry Matter Total	C23	No	Cumulative total of diet dry matter.

Note: Cells in blue are modified by the user.

Methods of Entering As-Fed Diet Composition

In the As-Fed Diet Composition column (C7 to C21), three methods can be used to enter composition values. The following table outlines each method.

Percent	Enter each ingredient as a percentage of the total. For accurate ration balancing, the As-fed Total (C22) must add up to 100.
Pounds in ration	Enter each ingredient as a function of weight. For example, if formulating for a 2000-pound complete ration, the As-Fed Total (C22) must add up to 2000.
Pounds of intake	Enter each ingredient as a function of intake. For accurate ration balancing, the Dry Matter Total (C23) must be equivalent to the Estimated DMI lbs/hd/day (C26).

Dry Matter Intake (DMI):

Estimated performance is based on expected dry matter intake. Dry matter intake is predicted for the user based on NRC equations. The user may adjust the dry matter intake by changing the DM adjuster cell (C27).

When set at 100%, the estimated dry matter intake is equal to the NRC predicted dry matter intake. For example, if DM adjuster is changed to 105%, the estimated dry matter intake will be 5% higher than the predicted dry matter intake. Dry matter intake is also shown as a percentage of body weight (D25 and D26). Equations to calculate dry matter intake differ for weanling and yearling age cattle; therefore, it is important that an accurate age estimate be entered in the **Calf Info** sheet in the Calf Age cell (D39).

Nutrient Profile:

The nutrient profile shows the profile of the combined ingredients entered based on their relative proportion. The values are only as accurate as the values entered into the **Feed List** sheet. For example, if mineral compositions are missing from select feeds within the **Feed List**, then the mineral estimates will not be accurate. Therefore, double check and make sure all values are accounted for in the **Feed List** before drawing conclusions about the nutrient profile. The percent of requirement met appears in **red** (cells K5 to K27).

Performance Indicators

Indicator	Cell	Cell(s) can be modified?	Description
Calf Weight	C31	No	This shows the weight of the calf for which the ration is being balanced. This weight is equivalent to the average weight found in cell D42 of the Calf Info sheet.
Desired Rate of Gain	C32	No	This shows the desired rate of gain that is being formulated. This rate of gain is equivalent to the gain found in cell D23 of the Calf Info sheet.
Energy Predicted Rate of Gain	C33	No	This is the Estimated Rate of Gain based on the energy content of the diet. The Estimated Rate of Gain will not be accurate if the CP required (I12) is not equal to or less than the CP provided (H12). The diet composition must be adjusted until Energy Predicted Rate of Gain is close to the Desired Rate of Gain. Note: The CP required is based on the Desired Rate of Gain.
As-Fed Feed Cost Per Lb Gain	C34	No	Calculated cost per pound of gain.
Dry Matter Feed Conversion	C35	No	Dry matter feed intake required to put on one pound of gain.

Feed List (Figure 3)

Feed List contains the nutrient composition of various feed ingredients. Feed values are entered on a Dry Matter basis. Nutrients in **black** are NRC values and cannot be modified. Net Energy values in the spreadsheet are calculated from TDN. Nutrients in **red** are average values for hays from the Arkansas hay database. Values in **blue** may be completed by the user, such as adding

results from current hay tests or analysis of feedstuffs. The nutrient profile portion of the **Ration Formulation** sheet is only as accurate as the values placed in the **Feed List**. If some of the ingredients used are missing values for minerals, the calculated nutrient profile will be inaccurate. If entering a feedstuff analysis such as a hay test and values are missing, such as mineral content, consider using mineral values based on averages from similar hays reported in the spreadsheet.

Feed Blend (Figure 4)

The **Feed Blend** sheet allows the user to select the ingredients that will be blended together to make up the mixed feed portion of the diet. Enter the Batch Size in pounds in cell C4. To accomplish this, enter Y (yes) or N (no) in the Items to Keep column (cells A8 to A23). For example, if hay, corn, and cottonseed meal are all a part of the feed formulation, the corn and cottonseed meal can be selected from the feed blend to determine how many pounds must be added for blending. In addition, the **Feed Blend** sheet will also show how many pounds to feed. This is helpful if feed formulation is based on a percent of intake. Batch size can be adjusted to accommodate desired batch size. If formulating a salt-limited ration, enter Y (yes) at the bottom of the Items to Keep column (A23). Salt limiting is based on a salt limit of 0.1 lb salt per hundred pounds body weight. The body weight used for salt limiting is the Average Weight calculated in **Calf Info** cell D42. The maximum salt intake is added in addition to the remaining ingredients selected in the Items to Keep column.

Figure 1. **Calf Info** Screen Example

A		B		C		D		E		F		G		H		I		J		K		L										
1	Producer Information																															
2	Name:		Feed Scoop Ranch																													
3	Address:																															
4	City:																															
5	State:																															
6	Zip:																															
7	Phone:																															
8																																
9	Number of Head		100																													
10	Sex		HEIFER(s)																													
11	Start date:		4/15/2004																													
12	Start weight (lbs)		350																													
13	Start Body Condition		5																													
14																																
15	Calf Breed Type		ENGLISH																													
16																																
17	Estimated mature weight (lbs)		1100																													
18	Target % of Mature wt		64%																													
19	Target Ending weight (lbs)		704																													
20	Target Ending date		10/7/2004																													
21																																
22	Estimated Feeding Days		175																													
23	Required Rate of Gain (lbs/d)		2.02																													
24																																
25	Projected Weights at:																															
26			2.02 lb/d gain																													
27			<table border="1"> <thead> <tr> <th>Days</th> <th>End Wt</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>350</td> </tr> <tr> <td>28</td> <td>407</td> </tr> <tr> <td>56</td> <td>463</td> </tr> <tr> <td>84</td> <td>520</td> </tr> </tbody> </table>																				Days	End Wt	0	350	28	407	56	463	84	520
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Figure 2. Ration Formulation Screen Example

Feed No	Ingredient Name	As-Fed Diet Composition	\$/Cwt As-Fed
103	Arkansas Bermuda Hay Avg	50	\$0.00
433	Wheat Middlings	7.5	\$6.30
607	Soybean Hulls	30	\$5.75
505	Corn Gluten Feed	12.5	\$6.25
405	Corn Grain Cracked		\$7.95
As-Fed Total		100	
Dry Matter Total		88.7	
Predicted DMI: lbs/hd/d, %BW		12.26	2.45
Estimated DMI: lbs/hd/d, %BW		12.26	2.45
DMI Adjuster		100	% Predicted DMI

NUTRIENT PROFILE				
	DIET DM COMP	DIET PROVIDED	ANIMAL REQ.	Percent Requirement
Dry Matter %	88.7		-----	
NDF %	63.9		-----	
eNDF (%DM)	34.1			
TDN %	70.4			
ME (Mcal/lb)	1.16	4.57	4.57 Mcal	100%
NE _m (Mcal/lb)	0.74	2.86	3.01 Mcal	95%
NE _g (Mcal/lb)	0.47	1.66	1.57 lbs	106%
CP %	13.5	1.161	1.122 lbs	103%
DIP (%CP)	69.9			
Fat %	2.7			
Ca %	0.43	0.053	0.061 lbs/d	87%
P %	0.38	0.047	0.033 lbs/d	143%
Mg %	0.25	0.25	0.1 %	255%
K %	1.57	1.57	0.6 %	262%
Na %	0.06	0.06	0.08 %	78%
S %	0.21	0.21	0.15 %	140%
Co ppm	0.12	0.12	0.1 ppm	117%
Cu ppm	12.58	12.58	10 ppm	126%
I ppm	0.02	0.02	0.5 ppm	4%
Fe ppm	267	267	50 ppm	533%
Mn ppm	101.33	101.33	20 ppm	507%
Se ppm	0.18	0.18	0.1 ppm	183%
Zn ppm	48.94	48.94	30 ppm	163%

PERFORMANCE INDICATORS	
Calf Weight (lbs)	500
Desired Rate of Gain (lbs/d)	2.02
Energy Predicted Rate of Gain (lbs/d)	1.91
As-Fed Feed Cost per lb gain	0.215
Dry Matter Feed Conversion (Feed:Gain)	6.4

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Figure 3. Feed List Screen Example

	A	B	D	E	F	G	H	I	J	K	L
	Feed No.	Common Name	\$/Cwt As-Is	Conc % DM	Forage % DM	Dry Matter %	NDF % DM	eNDF %NDF	TDM % DM	ME Mcal/lb	NE _m Mcal/lb
1											
2											
3											
4											
5											
6	101	Bahiagrass 30% Dry Matter	\$0.00	0	100	30	68	41	54.0	0.89	0.50
7	102	Arkansas Bahia Hay Avg	\$3.25	0	100	88	71	98	57.0	0.94	0.55
8	103	Arkansas Bermuda Hay Avg	\$0.00	0	100	87	74	98	60.0	0.99	0.60
9	104	Brome Hay Pre-bloom	\$0.00	0	100	88	55	98	60.0	0.99	0.60
10	105	Brome Hay Mid Bloom	\$0.00	0	100	88	57.7	98	56.0	0.92	0.53
11	106	Brome Hay Late bloom	\$0.00	0	100	91	68	98	55.0	0.90	0.52
12	107	Brome Hay Mature	\$0.00	0	100	92	70.5	98	53.0	0.87	0.49
13	108	Fescue Meadow Hay	\$0.00	0	100	88	65	98	56.0	0.92	0.53
14	109	Fescue, Alta Hay	\$0.00	0	100	89	70	98	55.0	0.90	0.52
15	110	Arkansas Fescue Hay Avg	\$0.00	0	100	91	67	98	54.0	0.89	0.50
16	111	Fescue, K31 Hay, Full bloom	\$0.00	0	100	91	67	98	58.0	0.95	0.56
17	112	Fescue, K31 Mature	\$0.00	0	100	91	70	98	44.0	0.72	0.34
18	113	Blank	\$0.00	0	0	0	0	0	0	0.00	0.00
19	114	Blank	\$0.00	0	0	0	0	0	0	0.00	0.00
20	115	Orchardgrass Hay, Early bloom	\$0.00	0	100	89	59.6	98	65.0	1.07	0.67
21	116	Orchardgrass Hay, Late bloom	\$3.25	0	100	90.6	65	98	54.0	0.89	0.50
22	117	Blank	\$0.00	0	0	0	0	0	0	0.00	0.00
23	118	Blank	\$0.00	0	0	0	0	0	0	0.00	0.00
24	119	Blank	\$0.00	0	0	0	0	0	0	0.00	0.00
25	120	Ryegrass Hay	\$0.00	0	100	88	41	98	64.0	1.05	0.66
26	121	Sorghum Sudan Hay	\$0.00	0	100	91	66	98	56.1	0.92	0.54
27	122	Sorghum-Sudan Pasture	\$0.00	0	100	18	55	41	65.0	1.07	0.67
28	123	Sorghum-Sudan Silage	\$0.00	0	100	28	68	41	55.0	0.90	0.52
29	124	Timothy Hay Late Vegetative	\$0.00	0	100	89	55	98	62.0	1.02	0.63
30	125	Timothy Hay Early bloom	\$0.00	0	100	89	61.4	98	59.0	0.97	0.58
31	126	Timothy Hay Mid bloom	\$0.00	0	100	89	63.7	98	57.0	0.94	0.55
32	127	Timothy Hay Full bloom	\$0.00	0	100	89	64.2	98	56.0	0.92	0.53

Ready NUM

Figure 4. Feed Blend Screen Example

	A	B	C	D	E	F	G	H
1	Feed Blending Sheet							
2								
3								
4			Batch Size (lbs)	2000				
5								
6	Items to Keep		Intake	Selected	Percentage	Pounds		
7	(Y or N)	Ingredient	(lbs/hd)	Ingredients	of Selected	Per		
8	n	Arkansas Bermuda Hay Avg	6.91	0.00	0.0	0		
9	y	Wheat Middlings	1.04	1.04	15.0	300		
10	y	Soybean Hulls	4.14	4.14	60.0	1200		
11	y	Corn Gluten Feed	1.73	1.73	25.0	500		
12	y	Corn Grain Cracked	0.00	0.00	0.0	0		
13	y		0.00	0.00	0.0	0		
14	y		0.00	0.00	0.0	0		
15	y		0.00	0.00	0.0	0		
16	y		0.00	0.00	0.0	0		
17	y		0.00	0.00	0.0	0		
18	y		0.00	0.00	0.0	0		
19	y		0.00	0.00	0.0	0		
20	y		0.00	0.00	0.0	0		
21	y		0.00	0.00	0.0	0		
22	y		0.00	0.00	0.0	0		
23	n	Salt Limit Intake	0	0	0.0	0		
24		Sum	13.81	6.91	100	2000		
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The spreadsheet and user's guide were developed by Dr. Shane Gadberry, Assistant Professor – Livestock Specialist.

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