



Current Report

Division of Agricultural Sciences and Natural Resources • Oklahoma State University

OSU Cowculator: Beef Cow Nutrition Evaluation Software

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This Current Report is intended for use with the OSU Cowculator Software Program. A copy of the software can be obtained through your county Extension office.

- A 3.5 inch floppy disk drive.
- At least 6MB of free hard disk space.
- A VGA (or better) graphics display.
- At least 8MB of memory (RAM); 16 MB is recommended.

Introduction

Feed and grazing costs make up 50% to 70% of annual production costs in typical cow/calf operations. Consequently, cow/calf producers must continually evaluate grazing and supplementation programs to ensure efficient use of available resources, while optimizing animal performance and minimizing supplemental feed costs. OSU Cowculator is a Windows-based computer software program designed to assist cattlemen in making informed decisions associated with beef cow nutrition. Animal criteria such as cow weight, body condition, stage of production, and breed, as well as the feed and forage library, can be customized to each operation, or to specific scenarios within an operation. Animal requirements and performance predictions are based on years of research data, which includes the 1996 and previous versions of the National Research Council's (NRC) Nutrient Requirements of Beef Cattle.

A unique aspect of this beef cow nutrition software is the optional grazing management and forage budget component. This section of the program assists producers in evaluating grazing costs, planning forage use, and comparing nutritional programs based on grazed versus harvested forage. Cowculator can be used as a decision making tool for individual operations and is especially useful as a teaching tool.

If the user has limited training in beef cattle nutrition, the local OSU Extension Ag Educator or other nutritionist should be consulted before implementing the feeding program. Simply meeting the requirements calculated by this program does not guarantee the ration is safe to feed or will result in satisfactory animal performance.

Getting Started

System Requirements

- To use Cowculator you need:
- Any IBM compatible machine with a 486 processor or higher.
 - Windows 95 operating system.

Installation

To install Cowculator:

1. Start Windows.
2. Insert Disk #1 in drive A or B.
3. From the START menu, choose RUN.
4. Type:
A:\setup ENTER (if you inserted the disk in drive A)
B:\setup ENTER (if you inserted the disk in drive B)
5. Follow the setup instructions on the screen.

During the setup, you are given the opportunity to specify the directory (folder) Cowculator will be installed in. You can accept the default directory (recommended) or change the drive and/or directory by editing the directory path displayed, and then choose NEXT.

Printing

Three printed reports can be obtained by typing the following macros.

<i>Simultaneously typing...</i>	<i>Prints report named...</i>	<i>Description:</i>
Control + S	<i>Summary</i>	Prints a summary of inputs and outputs from current <i>Conditions and Balancer</i> pages
Control + V	<i>Forage Value</i>	Prints the current <i>Forage Value</i> page
Control + B	<i>Forage Budget</i>	Prints the current <i>Forage Budget</i> page

Reports may also be printed by choosing the corresponding named setting.

From the FILE menu, choose NAMED SETTINGS, and double click on the report to be printed. Return to the FILE menu and choose PRINT. This report will remain the default report until another is selected.

Saving Files

Cowculator files are called workbooks and are identified with the file extension '.bwb'. As specific data is entered for each evaluation in Cowculator, changes can be saved in the current workbook by choosing SAVE from the FILE menu. This will update all entries that have been made since the last save.

Users may also select the SAVE AS command from the FILE menu and rename the workbook. This option will create a new workbook with the settings you entered while leaving the original workbook in tact. Each newly named workbook can take up to 2MB of memory and must be viewed from within Cowculator.

Using the Software

To simplify software use, Cowculator is divided into seven screens which are accessed by clicking on the appropriate tab at the bottom of the screen. *These tabs include Conditions, Feed List, Balancer, Forage Value, Forage Budget, Summary, and Print.* A brief explanation of required inputs, generated outputs, and the interaction of each component is provided below.

Conditions

The *Conditions* page allows the user to define the feeding period and type of animal being considered. This information is used to calculate the animal's nutrient requirements.

Number of cattle

This entry is intended to represent the total number of beef cows to be considered in the evaluation. In some cases this may represent the whole herd inventory. However, if cattle are managed in separate groups, or if significant variation in animal size or stage of production exists within a group, the user may want to do separate evaluations representing two or more groups of cattle. The more accurate the description of the animals and feeds, the more accurate the information returned.

Feeding period

Beside the word "From," enter the beginning date of the period you wish to evaluate. Likewise, beside the word "To," enter the ending date of the particular feeding period. It is strongly suggested that a period no longer than 100 days be evaluated at a time, as animal requirements and grazed forage quality can vary dramatically during this interval. It is also recommended that each period evaluated falls within one of the four stages of production indicated in the second section of the *Conditions* page. Dates are given to indicate average beginning and ending dates for each of the four stages of production. These times are calculated based on average breeding and calving dates.

Total Days

This is a calculated value and not an entry cell. The computer subtracts your ending date from your beginning date to compute total days during the feeding period.

Average Breeding Date

Use this entry cell to indicate the average date on which a group of cows becomes pregnant. If the average calving date is

easier to obtain or predict, change the average breeding date until it matches the anticipated average calving date.

Average Calving Date

Based on a 283-day gestation length, this software calculates the average calving date.

Cow Weight

Enter the average weight of a group of cows. It is critical that this entry represents the weight of a group of cows when they are:

- 1) In average body condition (Score 5).
- 2) Not pregnant or in early to mid-gestation. Cow weights taken during late gestation can be inflated by as much as 150 lbs.

If direct cow weights are not available, cull cow receipts can be helpful, assuming they meet the above criteria.

See OSU Cooperative Extension Service Circular E-869, Management of Beef Cattle for Efficient Reproduction, for a description of the cow body condition scoring system and photographs representing each score. This circular also discusses, in depth, the influence body condition has on reproductive performance.

Initial Body Condition Score

Indicate the actual or anticipated body condition score of your cows on the date indicated as the beginning of the feeding period. The average of the Initial and Desired Body Condition Score is used to calculate maintenance energy requirements. Cows in thinner conditions have lower maintenance requirements compared to cows in fatter conditions, assuming there is no cold stress.

Desired Body Condition Score

Enter the target or desired body condition at the end of the feeding period. The difference between the Initial and Desired Body Condition Score will determine the amount of weight gain or loss targeted during this feeding period. The user then compares the projected weight gain or loss with the desired weight gain or loss to decide if nutrient concentration in the diet is adequate.

Expected Calf Birth Weight in Pounds

Enter the average calf birth weight anticipated for calves out of your group of cows. This value is used in an equation to determine energy and protein needs for fetal development during late gestation.

Stage of Production

Enter the code (1, 2, 3, or 4) corresponding to the stage of production best matching the feeding period. The suggested dates corresponding to each stage of production are calculated based on average calving dates. Dates for Late Lactation are then calculated a 210 day average weaning age.

Breed Composition

Because differences in maintenance energy requirements have been established among breeds, Cowculator allows the user to indicate genetic makeup of the cow herd. Breed makeup is also necessary to predict average milk production (see the following section). 28 beef and dairy breeds are listed. Enter a percentage in the entry cell next to the corresponding breed.

Examples:

- 1) For purebred Hereford cows, enter 100 beside Hereford. It is not necessary to enter a "%" sign.
- 2) For black baldy cows out of Hereford cows and sired by Angus bulls, enter 50 beside Hereford and 50 beside Angus.
- 3) A set of cows sired by Simmental bulls and out of Limousin x Brangus cows is entered as 50% Simmental, 25% Limousin, and 25% Brangus.

The total at the bottom of the Breed Composition Table must equal 100 before proceeding!

Milk Production

Milk production may vary as much within a breed of cattle as it does among breeds. This section of the *Conditions* page allows the user to adjust milk production based on the level of cow productivity. Three adjustments are available: low (80% of average), average (based on NRC, 1996), and high (120% of average). Enter the code (1, 2, or 3) corresponding with the desired adjustment. A table to assist in determining level of milk production is available by simultaneously pressing the Ctrl + M keys. Find the row corresponding to the correct cow weight and follow it across the columns until you reach the steer calf weaning weight at 210 days of age that most closely reflects your weaning weights. The peak milk production indicated at the top of this column is the estimated peak milk production for your cows. The accuracy of this estimate will vary depending on forage quality, forage quantity, level of supplementation, weather conditions, and animal health. To return to the *Conditions* page, simultaneously press Ctrl + R.

Once you have completed the *Conditions* section of the software, click on the *Feed List* tab at the bottom of the screen, or select from the GO TO drop down menu.

Feed List

The *Feed List* contains a limited number of feeds common to Oklahoma in the following categories: grazed forages, harvested forages, commercial feeds, feed grains, and oil seeds; byproducts; and vitamins, minerals, and additives. Within each category, several blank rows have been provided to encourage users to customize the library for their own operation.

Nutrient concentrations for columns labeled Protein, TDN, NEM, Ca, P, Forage, and Waste are entered on a dry matter basis. Entries required for columns labeled #/Unit, \$/Unit, and D.M.% should be entered on an "as fed" basis. Additional information related to specific columns in the *Feed List* is provided below.

Feed Name and Number

The number to the left of the Feed Name is used to identify each feed when importing feeds into the *Balancer* page. These numbers are specific to each row and cannot be changed. However, the Feed Name and associated nutrient specifications can be changed.

#/Unit and \$/Unit

The Units column indicates (in pounds) the units in which feed is priced in the \$/Unit column. For example, if corn is priced on a bushel basis, the user enters 56 in the Units column (56 lbs. per bushel) and the price per bushel in the \$/Unit column. If corn is priced per ton, the user enters 2000 in the Units column.

TDN and NEM

Enter the percent total digestible nutrients on a dry matter basis. The program automatically calculates and enters net energy for maintenance (NEM). If a feed analysis provides a value for both TDN and NEM, change the TDN value in the *Feed List* until NEM matches the NEM value given in the feed analysis. The program uses NEM to calculate nutrient requirements and to predict weight gain or loss.

% Forage

This column is used to separate the forage portion of the diet from the concentrate portion of the diet in the *Summary* page. This separation enables the software to calculate forage dry matter intake and forage intake on a percent of body weight basis. The column can also be used to separate any specific forage from the rest of the diet in order to calculate intake of a particular forage. To do this, set the % Forage column at 100 for the forage of interest, and set the % Forage column at 0 for all other ingredients (including other harvested forages).

% Waste

Enter the percent waste for each ingredient on a dry matter basis. Waste is defined as any loss that occurs during storage and/or feeding. Storage loss is only included for feeds that incur additional loss after a feed has been priced (in the case of harvested forages) or purchased. For example, if hay is purchased and fed immediately, no storage loss should be considered. However, if hay is stored outside with no cover, and the price used in the *Feed List* reflects the value at harvest or purchase price six months ago, some storage loss should be considered. Tables 1, 2, and 3 provide guidelines regarding storage and feeding losses.

For additional information on storage and feeding loss of hay, see OSU Extension Facts: F-2570, Reducing Winter Feeding Costs; and F-1716, Round Bale Hay Storage.

Table 1. Percent Dry Matter Loss of Round Hay Bales^{ab}.

Storage Method	Storage Period	
	Up to 9 months ^c	12 to 18 months
Exposed		
Ground	5 - 20	15 - 50
Elevated	3 - 15	12 - 35
Covered		
Ground	5 - 10	10 - 15
Elevated	2 - 4	5 - 10
Under roof	2 - 5	3 - 10
Enclosed barn	Less than 2	2 - 5

^a From Huhnke, 1993.

^b The lower value of each range represents well-formed bales located in low rainfall areas such as northwestern Oklahoma (less than 25 inches annually) and low relative humidity. The higher values are for areas such as southeastern Oklahoma with high rainfall (greater than 40 inches annually) and high relative humidity.

^c If used before spring warm-up.

Table 2. Effect of Storage System on Dry Matter Loss of Ryegrass Hay Stored for Seven Months^a.

Storage System	Source of Loss		Total
	Storage	Animal Refusal	
Ground	28	22	50
Gravel	31	17	48
Tires	35	6	41
Rack	26	6	32
Rack with cover	12	2	14
Barn	2	1	3

^a From Redmon, 1996.

Table 3. Dry Matter Loss of Large Round Hay Bales Due to Transporting and Feeding^a.

Item	Range	Average
Transporting hay	1 - 5	3
Feeding method		
Hay ring	1 - 20	10
No hay ring	5 - 45	20
Rolled out	5 - 25	15

^a Adapted with modifications from Wheaton, 1980, and Anderson and Mader, 1985.

Balancer

The *Balancer* page allows the user to enter feeds of interest and indicate the amount to be fed or consumed by the animal. Cowculator then assists the user in determining the adequacy of the diet and adjusts supplementation based on previously determined nutrient requirements.

Diets are balanced using ratios for dry matter intake, protein, calcium, and phosphorus. Energy content of the diet is evaluated by comparing estimated weight gain or loss to target weight gain or loss. Each ratio is derived by dividing the amount of each nutrient supplied in the diet by the calculated requirement. For example, if 20 lbs. of dry matter is supplied and the predicted dry matter intake is 23 lbs., the intake ratio is .87. Moreover, if 26 lbs. were supplied, the intake ratio would be 1.13.

First enter the Feed Number, from the left-hand column of the *Feed List*, for each feed or forage of interest. Next, enter the amount (on an as fed basis) of each feed to be provided.

For cattle receiving mainly harvested forages, the simplest way to begin is to enter any amount (20 lbs. is suggested) for the major forage component in the diet. Second, adjust the forage intake until the Intake Ratio is at or near 1.0. The third step is to evaluate the Protein Ratio and correct any deficiency in protein intake. **The intake equation predicts dry matter intake for diets with adequate protein.** Consequently, if the intake ratio is below 1.0, forage intake, and subsequently, weight gain will be overestimated. Once the user has adjusted any protein deficiency, estimated weight change should be evaluated and com-

pared to desired weight change. At this point, the user must determine if the estimated weight change is acceptable, and if not, make necessary adjustments to energy intake. This can be done by adding concentrates or harvested forages with high TDN. Note that the cost per day of the feed/forage combination is given in the upper right corner. You may want to experiment with alternative plans to determine whether a lower cost combination exists.

To evaluate existing supplementation programs for grazing cattle, enter the amount of supplement you expect to provide, then through trial and error, adjust the forage pounds per day until the Intake Ratio is at or near 1.0.

Note: The intake equation uses dietary energy concentration to predict daily dry matter intake. Consequently, predicted dry matter intake is responsive to changes in supplement amount and ingredient energy concentration.

Forage Budget

The *Forage Budget* and *Forage Value* pages assist in planning forage use and determining the value of grazed forage based on input costs. Both of these pages can be used in conjunction with other Cowculator components to evaluate specific scenarios where grazed forage comprises the major component in the diet. In addition, *Forage Budget* and *Forage Value* can be used as independent decision making tools for any grazing enterprise.

The *Forage Budget* should be completed before proceeding to the *Forage Value* page. This is because total costs per acre, generated in the *Forage Budget*, are used to calculate pasture cost per head per day, and cost per ton of consumed forage on the *Forage Value* page.

The *Forage Budget* can be completely tailored to the user's operation and/or preference. The only limitation is input costs must be entered to reflect costs on a per acre basis. First, indicate the length of the period you want your budget to reflect. Next, enter the percent of operating capital borrowed, as well as the operating capital interest rate. These values are used to determine the amount of operating interest (associated with forage production costs) assigned to the grazing period. Input costs are divided into operating (variable) and fixed categories. Enter the units (pounds, acres, gallons, tons, etc.), price per unit, and number of units per acre under the columns labeled Units, Price, and Quantity, respectively. Operating capital interest is calculated automatically based on the information provided above.

If the land is leased, fixed costs should reflect the rental charges associated with the period indicated at the top of the budget. In the case of owned land, fixed costs can reflect the total of interest and principal payments, opportunity costs, taxes, and insurance. Again, only those fixed costs that are associated with the period indicated at the top of the budget should be considered. If the period is less than one year, the simplest method to allocate fixed costs to this period is to divide the annual fixed costs by the number of days or months associated with this period. However, if the grazing period will, in effect, use the total forage crop for the year, the full year cost should be assigned.

Once the *Forage Budget* is completed, the total cost per acre is automatically transferred to the *Forage Value* page.

To print the current *Forage Budget*, simultaneously press Ctrl + B.

Forage Value

Necessary inputs for the *Forage Value* page include number of cattle, length of period, estimated daily forage intake per head, percent harvest efficiency, and estimated forage production (in the case of growing forage) or availability (in the case of dormant forage). **To accurately calculate the pastured cost per head per day and cost of consumed forage, the number of cattle and period length must match those values entered in the Forage Budget.**

Once these inputs have been entered, the newly calculated cost per ton of consumed forage (on an "as fed" basis) can be transferred to the feed list for a particular grazed forage. This allows for a more accurate economic evaluation of nutrition programs based on grazed forage.

To print the current *Forage Value* screen, simultaneously press Ctrl + V.

Summary

The *Summary* provides an overview of costs, change in body condition, and diet composition. No inputs are required for this page. From this information the user can determine:

- 1) The amount of harvested forage or supplement to feed a group of cattle each day.
- 2) The costs associated with each dietary ingredient on a per head per day basis or for the entire period.
- 3) The total amount of harvested forage or supplement to inventory, contract, and purchase.
- 4) The costs associated with storage and feeding loss of harvested forage and supplement.

Print

The *Print* page combines input values from the *Conditions* and *Balancer* page with information from the *Summary* page in a concise, one-sheet summary.

To print this page, press the Ctrl + S key simultaneously.

Additional Considerations

Weather

Cowculator does not adjust maintenance requirements for cold stress during winter. Weather can play a significant role in feeding management, as cold stress increases maintenance energy requirements while having little effect on protein, mineral, or vitamin requirements. However, extreme weather conditions necessary to warrant ration changes in Oklahoma are infrequent, often short-lived, and nearly impossible to predict. When cattle have access to shelter though, be it man-made or natural, the effects of wind are greatly reduced. Consequently, planning a 60 to 90 day nutrition program based on extreme weather is not advised. A logical approach is to plan your nutrition program for a particular period and make short-term ration adjustments as needed. The following information provides guidelines for ration adjustments when extreme weather conditions exist.

Beef cows have a wide thermoneutral range (approximately 30 to 70 °F) at which they are "comfortable". The lower critical temperature is defined as the effective ambient temperature at which energy intake must increase in order to minimize weight loss. Lower critical temperature depends largely on hair coat length and hair coat condition (dry versus wet) as shown in Table 4.

Table 4. Estimated Lower Critical Temperatures for Beef Cattle.^a

Coat Description	Lower Critical Temperature
Wet or summer coat	60°F
Dry fall coat	45°F
Dry winter coat	32°F
Dry heavy winter coat	19°F

^a From Brownson and Ames. Winter Stress in Beef Cattle. Great Plains Beef Cattle Handbook. 1985

The combined effects of temperature and wind are often expressed as a Wind-Chill Index (WCI) and can be used to estimate effective ambient temperature. Table 5 shows the Wind-Chill Index values for cattle.

Table 5. Wind-Chill Index for Cattle.^a

Wind Speed, (mph)	Temperature (°F)						
	-10	0	10	20	30	40	50
0	-10	0	10	20	30	40	50
5	-16	-6	3	13	23	33	43
10	-21	-11	-1	8	18	28	38
15	-25	-15	-5	4	14	24	34
20	-30	-20	-10	0	9	19	29
25	-38	-27	-17	-7	2	12	22
30	-46	-36	-27	-16	-6	3	13

^a From Brownson and Ames. Winter Stress in Beef Cattle. Great Plains Beef Cattle Handbook. 1985.

For cows with dry hair coats, total digestible nutrient (TDN) supply should be increased by 1% per degree WCI below the lower critical temperature. For example, if cows have a dry winter coat and the WCI is 23, the TDN supply should be increased by 9%. For cows with wet hair coats, TDN supply should be increased by 2% per degree WCI below the lower critical temperature.

There are practical limits to how much the amount of energy intake can be increased. For cattle grazing on low quality forage or consuming moderate to low quality hay, it is very difficult to increase TDN intake more than 30%. A 30% increase in TDN for a moderate-sized cow grazing winter pasture is about equivalent to increasing the feeding rate of a concentrate supplement by 5 lbs. per head per day. In many cases, the cattle may already be receiving 2 to 5 lbs. of supplement per day. An additional 5 lbs. of feed may not be practical from a delivery or economic standpoint. If high quality hay is used to increase energy intake during severe weather, the digestibility of the hay becomes the limiting factor in improving energy intake.

Another limitation to significantly adjusting rations based on weather is related to feeding frequency. Many producers feed supplements three to four times per week to reduce labor and

equipment costs. Supplements fed beyond the equivalent rate of 4 lbs. per head per day must be fed every day. Otherwise, forage intake and digestion can be greatly compromised and cause a greater risk of digestive upset. Consequently, labor availability and/or ability to get to cows every day may limit the ability to increase energy intake through a concentrated supplement.

Mineral and Vitamin Supplementation

Cowculator evaluates adequacy of calcium and phosphorus in beef cow diets based on requirements from NRC, 1996. Vitamins and other macro and micro minerals are not evaluated in the software. Table 6 shows the requirements and maximum tolerable concentration for minerals (other than calcium and phosphorus), as well as vitamins A and D.

Table 6. Mineral Requirements and Maximum Tolerable Levels for Beef Cows and Bulls^a.

Mineral/Vitamin	Unit	Gestation	Early Lactation	Maximum Tolerable Level
Magnesium	%	.12	.20	.40
Potassium	%	.6	.70	3.00
Sodium	%	.06-.08	.10	-
Sulfur	%	.15	.15	.40
Cobalt	PPM	.10	.10	10.00
Copper	PPM	10.00	10.00	100
Iodine	PPM	.50	.50	50
Iron	PPM	50.00	50.00	1000
Manganese ^b	PPM	40.00	40.00	1000
Selenium	PPM	.10	.10	2.00
Zinc	PPM	30.00	30.00	500
Vitamins	PPM			
A ^c	IU/Lb. feed	1270	1770	-
D	IU/Lb. feed	125	125	-

^a Adapted from Nutrient Requirements of Beef Cattle, NRC, 1996.

^b Manganese requirement for breeding bulls = 20.00 PPM.

^c Vitamin A requirement for breeding bulls = 1000 IU/Lb.

See OSU Cooperative Extension Service Circular E-861, Mineral Nutrition of Grazing Cattle, for mineral composition of Oklahoma forages and feeds and guidelines in designing a mineral supplementation program for grazing cattle.

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