OSU CowCulator

A Tool for Evaluating Beef Cow Diets

Beef Cattle Sciences

Instructions for Use[1]

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The following instructions are for a modified version of the Oklahoma State University Cowculator. Also, significant portions of this publication have been taken directly from Oklahoma State University CR-3280 written by David Lalman and Don Gill. Modifications made by David Bohnert, Oregon State University, include a Protein Cost Calculator, TDN Cost Calculator, and an altered Forage Calculator.

Introduction

Annual feed costs for Oregon's beef producers are routinely greater than most, if not all, other regions of the U.S. Also, beef producers east of the Cascades (where 75% of Oregon beef cows are located) are challenged by a forage base that annually yields approximately 3 months of high-quality forage and 9 months of poor quality forage. In addition, there can be tremendous variability in annual forage production. Consequently, beef producers often must feed some form of harvested forage and/or supplement for 4 to 7 months of the year while continually evaluating grazing and supplementation programs to ensure efficient use of available resources so as to optimize animal performance and minimize supplemental feed costs. OSU Cowculator is an Excel spreadsheet program designed to assist cattlemen in making informed decisions associated with beef cow nutrition. Animal criteria such as cow weight, body condition, state 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.

If the user has limited training in beef cattle nutrition, your local OSU Extension Livestock/Range Agent or a beef cattle 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 that it will result in satisfactory animal performance.

Getting Started

To use Cowculator you need:

- Any IBM compatible machine with a Windows 95 or newer operating system.
- Microsoft EXCEL software program
- At least 8MB of memory (RAM); 16MB is recommended.

Installation

To install Cowculator from the website/email or from a CD/thumb drive:

1. Save the file to the computer's hard drive in a directory of the users choice
2. It is recommended to save the original file with a different name, such as "OriginalCowCulator", and then save another version for use, such as "CowCulatorWork", so that a copy of the original is readily available if the working file becomes corrupted.

Saving Files

Cowculator is an excel file and is identified with the file extension '.xls'. Excel files are referred to as workbooks. As specific data is entered for each evaluation in Cowculator, changes can be saved in the current workbook by either clicking on the save icon or by choosing SAVE from the FILE menu. This will update all entries that have been made since the last save. As noted in the *Installation* section, 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 intact.

Using the Software

To simplify software use, Cowculator is divided into eight sheets or pages, which are accessed by clicking on the appropriate tab at the bottom of the screen. These tabs include *Program Info, Conditions, Feed List, Balance, Protein Cost Calculator, TDN Cost Calculator, Total Cost Summary,* and *Forage Calculator.* A brief explanation of required inputs, generated outputs, and the interaction of each component is provided in the subsequent sections. Also, placing the curser above individual cells within each sheet with a red hatch in the upper right-hand corner will reveal a brief description of the required input(s).

Program Info

This page provides background information on the Cowculator spreadsheet.

Conditions

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

  Number of Cows. 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 cow size or stage of production exists within a group, the user may want to do separate evaluations representing each group of cattle. The more accurate the description of the cows and feed, the more accurate the information returned.

  Average Calving Date. Enter the average calving date for the herd. The corresponding average breeding date is calculated automatically.

  Calf Age at Weaning. Enter the expected average calf age at weaning for this herd. Calf weaning age is used to estimate the dates within a production cycle that correspond to the four stages of production.

  Stage of Production. Based on the dates given above, a table is generated that suggests dates that should be closely related to four different stages of production: mid gestation, late gestation, early lactation, and late lactation. Select 1, 2, 3, or 4 to indicate which stage corresponds to the feeding.

  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 cow requirements and grazed forage quality can vary dramatically during this interval. It is also recommended that each period evaluated fall 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.

  Days in feeding period. 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.

  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.

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

  Desired Body Condition Score. Enter the target or desired BCS 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.

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). Twenty-eight beef and dairy breeds are listed. Examples:

1. For purebred Hereford cows, enter 100 beside Hereford. It is not necessary to enter a "%" sign.
2. For black blady 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, 35% 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.

Once you have completed the *Conditions* section of the software, click on the *Feed List* tab at the bottom of the screen.

Feed List

The *Feed List* contains a limited number of common feeds for beef cattle in the following categories: forages and roughages, commercial feeds, feed grains and oil seeds, byproducts etc., 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 concentration for columns labeled CP (crude protein), TDN (total digestible nutrients), Ca (calcium), and P (phosphorus) are entered on a dry matter (DM) basis. Entries required for columns labeled lb/Ton, $/Ton, and DM% 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 *Balance, Protein Cost Calculator, and TDN Cost Calculator* pages. These numbers are specific to each row and cannot be changed. However, the feed name and associated nutrient specifications can be changed.

lb/Ton and $/Ton. In order for all the sheets to work properly, the feeds need to be listed and priced on a ton basis.

TDN and NEm. Enter the percentage TDN on a DM basis. The program automatically calculates and enters metabolizable energy (ME), net energy for maintenance (NEm), and net energy for gain (NEg). 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.

Balance

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

Diets are balanced using ratios for DM 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 DM is supplied and the predicted DM intake is 23 lbs., the intake ratio is .87 (20/23). Moreover, if 26 lbs. were supplied, the intake ratio would be 1.13 (26/23).

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 cows receiving mainly harvested forages, the simplest way to begin is to enter any amount (25 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. **However, the intake ratio is just meant to be a guide to help estimate intake.** Recent research at the Eastern Oregon Agricultural Research Center (Burns) has suggested that intake of low-quality, cool-season forages common in the Northwest is under-predicted by the program. Your personal experience and knowledge may suggest that cows will consume more than is predicted by the program; therefore, an intake ratio greater than 1.0 may be an acceptable choice in this instance.

The third step is to evaluate the Protein Ratio and correct any deficiency in protein intake. The intake equation predicts DM intake for diets with adequate protein. Consequently, if the intake ratio is below 1.0, forage intake and, subsequently, weight gain will be overestimated. **Do not add a protein supplement to the balance sheet until you have completed the Protein Cost Calculator.**

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

Protein Cost Calculator

If the Protein Ratio is less below 1.0 based on the DM intake and forage quality of your basal forage then it is time to determine how much supplemental protein is needed. The amount of "Supplemental CP Required,

lb/head/day" is calculated for you and is provided at the top of the *Protein Cost Calculator* page. In addition, the "Energy Balance Ratio" is calculated which will help provide an estimation of the energy status of the cow. The "Energy Balance Ratio" should be 1.0 or greater. A value less than1.0 (red color) means additional energy is required. If the protein requirement is met and the energy ratio is less than 1.0 an additional source of TDN is needed to balance the diet. This can be accomplished by adding concentrates or harvested forages with high a TDN concentration. Choosing the most cost effective TDN feedstuff can be simplified by using the *TDN Cost Calculator* (see description below) and add the selected TDN supplement in an appropriate amount to the *Balance* sheet to make the "Estimated ADG" match the "Desired ADG". The next two rows of the page simply provide the number of cows and the length of the feeding period, both of which were previously entered on the *Conditions* page.

To use the *Protein Cost Calculator* enter the Feed # from the *Feed List* for each of the protein supplements to be evaluated based on the ability to effectively use the supplement (supplement availability and ranch infrastructure). This will automatically insert the supplement into the sheet. Choose the supplement that will yield the lowest cost for the feeding period, assuming the other costs associated with supplementation are similar. The chosen supplement should then be added to the Balance sheet using the Feed # from the *Feed List*. The next step is to add the amount in the "As-Fed Daily Supp. Intake" column of the *Protein Cost Calculator* for the chosen supplement to the "Lbs/Day As-Fed" column of the *Balance* sheet. Double check the total DM intake and the intake ratio on the *Balance* sheet to make sure the total amount of feed provided is realistic. Adjust the diet as necessary based on cow performance and feed waste.

Also, once the user has adjusted for protein deficiency, estimated weight and BCS change should be evaluated and compared to desired weight and BCS change. At this point, the user must determine if the estimated weight and BCS change is acceptable, and if not, make necessary adjustments to energy intake.

TDN Cost Calculator

Choosing the most cost effective energy feed (grains, hays, etc.) can be confusing when comparing feedstuffs with differing DM content, TDN concentration, and costs. The TDN Cost Calculator can make this task much easier. Once all the potential feeds are included in the *Feed List* sheet, simply enter the Feed # into the *TDN Cost Calculator* and compare which feed is cheaper per unit TDN. Remember, if you include an energy supplement/feed on the *Balance* sheet the basal forage/feed may need to be reduced to maintain a realistic overall DM intake and intake ratio.

Total Cost Summary

The *Total Cost Summary* provides an overview of costs, change in BCS, 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 to a group of cows 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.

The *Total Cost Summary* page can be easily printed (select FILE – PRINT – PRINT from the Excel menu tabs) for filing and later evaluation of the overall feeding program.

Forage Calculator

This sheet assists the manager in estimating how long a pasture can support a given number of cows.

Number of Cows on Pasture. This cell is for entering the total number of cows that will be placed on pasture.

Cow Weight (lb). This cell requires entering the average weight of the cows assuming a BCS of 5.

Forage Dry Matter Intake. This input requires an estimation of DM intake as a proportion of BW. This will vary with season of use, forage type, and production state of the cows; however, we suggest using a value of 2.25 to 2.75 for early season (good quality forage) and 1.75 to 2.0 for late season use (poor quality forage). When this information is entered an estimate of forage DM intake will be automatically entered.

Pasture Size. The next step is to enter the amount of utilizable pasture available (in acres).

Forage Utilization Factor. This input requires the user to enter the desired level of forage utilization. The common management recommendation is take half and leave half (50%); however, this depends on the type of pasture and management objectives.

Total Available Forage. This series of cells relate to estimating the quantity of standing forage available in the pasture. The best predictor we have available for Wyoming Big Sagebrush-bunchgrass range is precipitation. Therefore, if precipitation amounts are known enter the amount, in inches, to get an estimate.

September to March precipitation will give an acceptable estimate but March to June precipitation will give a better overall estimate.

If the pasture being utilized is not Wyoming Big Sagebrush-bunchgrass range and/or you have actually determined the quantity of total available forage, or experience will allow you to provide and accurate "guess" you can enter that information in the "Clipped, Estimated, or Best Guess cell. Be sure and only use one method of estimating the standing forage. ***Forage Available for Use*** and ***Herd Grazing Days on Pasture*** will be estimated by the calculator once the above information has been entered.

On Pasture Date. This cell allows the user to input the date cattle will be placed into the pasture and will calculate the estimated ***Off Pasture Date*** based on the data provided.

Please note – this tool is for estimation and does not guarantee adequate forage availability or herd grazing days on pasture. Final pasture utilization and grazing duration should be determined by someone with knowledge of range and cattle management.

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.

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). However, **a general rule-of-thumb suggests that the TDN requirement will increase approximately 1% for each degree drop in temperature below 30 degrees.** Therefore, if the temperature dropped to 10 degrees the TDN requirement would be expected to increase by approximately 20%.

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 percent. A 30 percent increase in TDN for a moderate-sized cow grazing winter pasture is about equal to increasing the feeding rate of a concentrate supplement by five pounds per head per day. In many cases, the cattle may already be receiving two to five pounds of supplement per day. An additional five pounds of feed may not be practical from a delivery or economic stand point. 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.

Mineral and Vitamin Supplementation. Cowculator evaluates adequacy of calcium and phosphorus in beef cow diets based on requirements from NRC, 1996.

References

Bohnert et al. 2011. J. Anim. Sci. 89:3707-3717.

Brownson and Ames. 1985. Great Plains Beef Handbook. GPE 1900.

Marston et al. 1998. Kansas State University Agricultural Experiment Station C-735: 1-14.

Lusby and Selk. 1991. Circular E-861. Oklahoma Cooperative Extension Service. Oklahoma State University. NRC. 1996. Nutrient requirements of beef cattle (7th revised ed.).

Selk and Lusby. 1992. Circular E-869. Cooperative Extension Service. Oklahoma State University. Sneva 1982. Intern. J. Biometeorology 26: 267-276.

Wheaton. 1980. Science and Technology Guide. Univ. Missouri Ext. No. 4570.