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OSU Cowculator v2.0
Beef Cow Nutrition Evaluation Software

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Introduction

Feed and grazing cost make up 50 to 70 percent 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 v2.0 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, 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.

If the user has limited training in beef cattle nutrition, the local OSU Extension Ag Educator or another 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 486 processor or higher.
- Windows 95 operating system.
- Microsoft XL software or other compatible spreadsheet program.
- A VGA (or better) graphics display.
- At least 8MB of memory (RAM); 16MB is recommended.

Installation

To install Cowculator from a disk:

1. Start Windows.
2. Insert disk in drive A or B.
3. Double click on My Computer icon.
4. Double click on appropriate drive icon.
5. Double click on Cowculator icon.
6. If you prefer, save this program to your hard drive in order to run it from there rather than the disk.

Saving Files

Cowculator v2.0 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.

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.

Using the Software

To simplify software use, Cowculator is divided into four screens, which are accessed by clicking on the appropriate tab at the bottom of the screen. These tabs included *Conditions, Feed List, Balance,* and *Summary.* 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 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 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 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.

Weaning Date

Enter the expected weaning date for this herd. Calving date and weaning date are 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 1-4 to indicated 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 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.

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.

> 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 this 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.

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. 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 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, 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.

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, and P 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 *Balance* 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.

Balance

The *Balance* 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 compared 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.

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.

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. 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 show in the following table.

Table 1. Estimated Lower Critical Temperatures for Beef Cattle.*

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

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

Table 2. Wind-Chill Index for Cattle.*

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

*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. The following table shows the Wind-Chill Index values for cattle.

For cows with dry hair coats, total digestible nutrient (TDN) supply should be increased by one percent 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 nine percent. For cows with wet hair coats, TDN supply should be increased by two percent 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 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.

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 four pounds 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. The following table shows the requirements and maximum tolerable concentration for minerals (other than calcium and phosphorus), as well as vitamins A and D.

Table 3. 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 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.

References:

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