

Using the Least Cost Solver

Nutritional information and equations for nutrition calculations were obtained from scientific literature and can be used in your operation for your particular circumstances. The least cost ration calculator, tables for feed nutrient composition, and animal requirements are included in the Microsoft Excel 2000 file **Ration Calculator.xls**. Least cost rations will vary with ingredients you choose to feed and current prices of those commodities. If you desire not to include a particular feed ingredient in a ration, set the price at \$99 per lb.

Simplified Least Cost Example

Tab to the FEED MIXTURE CALCULATOR sheet. There is a least cost ration solver built into this sheet from cells A38:G44.

We wish to minimize the cost / lb. of ration. There are five different feedstuffs which are being considered for the ration: milo, bermuda grass hay, alfalfa hay, corn, and cottonseed meal. The original matrix shown is for mixing 100 lbs. of feed at a time. We can calculate the cost for 1 days ration for 1 animal or for 100 lbs. of feed. We can do this by changing the ration pounds to either 100 lbs. to whatever the total lbs. of daily ration is. One of the feed ingredients in cells B44 to F44 needs to be set at either 100 lbs. or the daily lbs. of ration fed to one animal. The National Research Council lists the following requirements for a 500 lb. medium frame heifer gaining 1 lb. a day:

Daily dry matter intake, lbs: 11.8
Metabolizable Energy (ME), Mcal/ lb. ration: 1.02
Net Energy for gain (NE_g), Mcal/ lb. ration: .36
Protein Requirement, % or lb./ lb. ration: .094

Since mid-term weight (550 lbs.) and average daily gain (1.25 lbs.) for the animal we are considering feeding is greater than the above, our requirements will be as follows:

Daily dry matter intake, lbs: 12.5
Metabolizable Energy (ME), Mcal/ lb. ration: 1.08
Net Energy for gain (NE_g), Mcal/ lb. ration: .40
Protein Requirement, % or lb./ lb. ration: .094

To calculate a least cost ration for this heifer, do the following:

- A: Change cell C44 to 12.5 or 100
- B: Go to cell G43
- C: Click on Tools on Menu bar.
- D: Then click on Solver...
- E: The Solver Parameters screen will appear.

Note. When you click on the Tools command, if the Solver command does not appear on the Tools menu, first click on Add-ins and make sure Solver Add-in is checked. If the Solver still doesn't appear, you will need to run the Microsoft Excel Setup program to install the Add-in.

Verify that the target cell is \$G\$43 (dollar signs lock in formulas, etc. to one specific cell address). We wish to minimize the price / lb., so verify that Min is highlighted and that the Value is set to 0. The cells we wish to change are B44 to F44 or the lbs. of each ration, so enter \$B\$44:\$F\$44 in the formula bar for *By Changing Cells*.

Next we need to set constraints for the least cost ration. Enter the formula bar for *Subject to the Constraints*. Click on the Add button. **If the constraints in this paragraph are already present in the Constraints window, highlight the desired constraint and click the Change button.** We do not wish for any negative lbs. of ration to be fed so a constraint will need to be added to make the lbs. of each ration greater than or equal to zero (\$B\$44:\$F\$44 \geq 0). Click on the Add button. The ration for the heifer we are feeding is specified by setting Mcal of ME / lb. of ration to \geq 1.08 (\$G\$40 \geq 1.08), click Add button; NE_g is set at \geq .40 (\$G\$41 \geq 0.4), click Add button; and protein is set at \geq .094 (\$G\$42 \geq .094), click Add button. (If you wished to make something less than or equal to zero, the abbreviation is \leq 0.) The last item listed on the solver parameter screen is the lbs. of feed. This needs to be = 100 (or 12.5 for daily feed). Enter the constraint \$G\$44 = 100 (or 12.5) and click the OK button to return to the Solver Parameters screen.

Now click on Solve and wait for the Solver results screen to appear.

If the feedstuffs would have been unable to satisfy the ration we specified, the Solver would give us a message that it was unable to find a solution. In this case, we were able to find a solution. You may obtain an answer in a couple of ways.

(1) If you do not wish to change the original lbs. of ration on the matrix shown in the spreadsheet, you can click on Restore Original Values and ask for a detailed Answer Report. If this is the option you prefer, highlight Answer, click on Restore Original Values, and click OK. The Answer Report will appear as a new sheet in this file and will be shown as ANSWER REPORT 2 in this spreadsheet.

(2) For a quick answer, just leave Keep Solver Solution highlighted and click OK. The ration will appear in the matrix in the spreadsheet. Total lbs. of each feedstuff will be shown in B44 to F44 and the cost / lb. of ration will be shown in G43.

The solution to the above problem is actually shown in ANSWER REPORT 1. The solution you obtained should be similar to ANSWER REPORT 1. **A quick note on least cost rations: Start out with 100% of your cheapest feedstuff in the original matrix (which we did with 100 lbs. of bermuda grass hay). Sometimes it may take more than one run to obtain a true least cost ration if you don't do this.**

The heifer we are feeding requires 12.5 lbs. of feed per day at a cost of ____ per lb.

Advanced Least Cost Example

For the example below, we will be balancing a ration for a 600 lb. medium frame steer gaining 3.0 lbs. per day. The nutritional constraints we need to set are as follows:

Net Energy for maintenance (NE_m), Mcal/ lb. ration: .95 (constraint is \$BK\$10 \geq .95)

Net Energy for gain (NE_g), Mcal/ lb. ration: .64 (constraint is \$BK\$11 \geq .64)

Protein Requirement, % ration: 12.9 (constraint is \$BK\$3 \geq .12.9)

Calcium, % ration: .57 (constraint is \$BK\$6 \geq .57)

Phosphorus, % ration: .29 (constraint is \$BK\$7 \geq .29)

Tab to the FEED MATRIX CALCULATOR sheet. This is an expanded least cost ration analyzer for feedstuffs more commonly found in southern Utah or in Arizona. If you wanted to use all the feedstuffs in the NRC feed library for a least cost ration, you could use the spreadsheet entitled FEED MATRIX. This is not advisable since you would have to set more feedstuffs to 0 in the Solver constraints to avoid having minuscule amounts of many feed ingredients.

The final solution for the steer indicated above was found after several runs with the FEED MATRIX CALCULATOR sheet and is shown in the Amount Fed row (\$C\$13:\$BJ\$13). Some ingredients were minimized by putting the price per lb. at \$99. The spreadsheet entitled NOT ENOUGH ROUGHAGE ANS. REPORT was the first answer generated in Excel using the FEED MATRIX CALCULATOR spreadsheet. The first ration obtained was low in roughage and could predispose cattle to acidosis and founder. There are also negative numbers listed for the final values. The second attempt at determining the least cost ration is shown in WITH MORE ROUGHAGE ANS. REPORT. To bring more roughage into the ration, a constraint was set for crude fiber \geq 12%. There were still some negative numbers generated and whole cottonseed was too high at 34%. Cottonseed in the diet at 24% reduced average daily gains with goats in one study. It appeared that the negative effects occurred at somewhere between 16% and 24% cottonseed in the diet. On the next run, constraints were set for cottonseed \leq 18, crude fiber was set at \geq 8, and several of the fresh grasses, silages, and stover were set at = 0. There were lots of entries for very small amounts of hay and protein products. However, the major ingredients were rather apparent after this run. We desired to only buy one kind of hay and to simplify the ration as much as possible. Therefore additional constraints were set for several of the various hay products = 0 except for alfalfa and Sudan hay. Alfalfa hay would help raise the protein in the ration and is easily obtained in Utah and Arizona. After doing this, a ration was generated with 1.29 lbs of corn gluten feed, 66.07 lbs. corn, 8.8 lbs. Sudan grass hay, .50 lbs. salt, .03 lbs. Rumensin, 4 lbs. molasses, 1.12 lbs. calcium carbonate, 18 lbs. cottonseed, and various small quantities of other ingredients. Since Sudan hay can often have problems with nitrates or prussic acid and the quality can be poor, it was decided to bring mature alfalfa hay into the diet instead of Sudan. To generate the final ration, the following values were entered in the FEED MATRIX CALCULATOR spreadsheet cells for lbs. of feed ingredients. All other cells in \$C\$13 to \$BJ\$13 were set to 0. You need to be careful and check each cell since the previous least cost runs can leave very small positive numbers in some cells.

Alfalfa hay, mature	cell G13	10 lbs.
Calcium carbonate	cell T13	1.25 lbs.

Corn grain, No. 2 dent	cell Y13	68.22 lbs.
Cottonseed	cell AF13	18 lbs.
Cottonseed meal, solvent	cell AH13	.50 lbs.
Molasses, sugarcane	cell AN13	1.5 lbs.
Rumensin	cell AV13	.03 lbs.
Salt	cell AW13	.50 lbs.

When the above values were entered, all nutritional requirements were met at a cost of .054 per lb.