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# Use of BroilerOpt™ Broiler Optimization Program

This program is designed to help minimize feed cost in growing broiler chickens.   The steps involve calibration of the current flocks, prediction of growth of those flocks to alternative feeding programs and optimization of feeding programs to find the lowest cost feeding option, or the lowest cost feeding program to a set feed conversion.

## Calibration:

The first step is calibration which matches the growth of flocks to the nutrition given.  The program does that by matching the growth curve of the breeds used or growth by age provided to the energy and amino acids provided in the formulated feeds.

The program always opens to the Calibration Tab.  A part of the Calibration Tab is shown below.  The needed data are 1) a location name that will store all the information about these flocks.  It is usually centered on a feed mill, since the feed ingredient costs are based here and the feeds tend to be the same across the flocks fed from the mill. 2) The sex of the flocks fed, if the flocks are fed sex-separate, one should have a location for males and one for the females.  Nutritional needs are different so that feeding separately allows formulating to those needs.  3) The average flock weight over the period considered.  4) The average feed conversion of the flocks. 5) the average finishing age of the flocks.  6) The number of diets fed and 6) the average weight of each feed that was fed, the energy, protein and



amino acids fed in each feed. If an amino acid was not considered limiting ( was not formulated with a minimum requirement), a zero is put for that value so the program knows that it was not limiting the growth.

The diet can be typed or copied into the grid where it is needed.  The order of nutrients is important. Energy must be the first nutrient given, protein second, and the amino acids (either total or available) must be in the order given above.  The names can be changed to match local practice, but the order is essential.

Once the data are entered, the "Run Calibration" button is activated and you can click it. When the calibration is completed, two values are shown in the Computed Feed Conversion line. These are the best fit feed conversion and finishing age. If these are too far from your given values, review your input data and make any changes needed. The feed weights are the likeliest source of error. Remember that age is the hardest value to predict or measure.



The "Save Calibration" button (on the bottom right, above) can now be clicked to save the location. The calibration values, the input values and the Energy, amino acid, weight selections will be saved as will the nutrients in the calibration diets. Once calibrations have been saved, the diets and input values can be used to calibrate another location or this location again, if that is helpful.

## "Current Flock" Tab:

Once a calibration has been done, it can be used to evaluate nutritional changes. Go to the Current Flock Tab for this. Should you want to look at the impact of more or less energy in any diet, the impact on growth rate and feed conversion will be predicted. Changing protein and amino acids can be done independently or one can choose to change all amino acids in ratio to protein or in ratio to lysine.

When matrix information has been loaded, diets can be formulated and costs computed directly. The ingredients in each diet will be displayed and limits on nutrients and ingredients will be honored by the least cost program.

The first step is to click on the arrow on the drop-down box labeled "Click on Desired Location" and choose the location you want. This will bring in the calibration information that was saved. You can then open the existing diets by clicking on [Open Diets] button. If you have matrix data, you can use the [Copy in Diets] to compute the nutrient contents from an ingredient formula.



Above, using the [Open Diets] button, we opened the diets that were saved for this location. By typing 1, 2, 3 etc. in the opened grid, the diet nutrients were transferred into the proper grid. If there were matrix data, the minimums and maximums would be opened as well.

Making any change on the "Nutrients" grid can be quickly evaluated. Changes in energy, protein, any amino acid and amount of each feed can give improvements in cost. Usually, the largest changes come from the feed with the largest weight of feed fed.

There is a drop-down box that shows [LP COST] above. If there are no formulation minimums and maximums saved for a location, this box will change automatically to [GIVEN COST]. This prevents the least cost program from running and will not alter the feed costs given.

The matrix data can be copied into the program, usually easiest from a spreadsheet. To copy in a matrix, organize it to match the grid you see when you open [Show Ingredient Info]. It can handle up to 100 ingredients and 50 nutrients.

To copy in the names of ingredients and nutrients as well as the matrix values, click on the [Edit Ing. Names] button on the bottom left of the window. The grid left most column will turn white, and the top

row will also be white.  Copy the data from the spreadsheet and paste into the top left box.  If you already have the names in place, just copy the new values into the top left box.

You can type in new names and values if you wish or paste one row into the grid to replace an ingredient.

There are several ways to update the matrix, including adding an ingredient, adding a single new nutrient, or importing values from a copied dataset.

When the ingredient matrix is entered, save it and then you can enter the ingredient minimum and maximum values.  This grid can be accessed by clicking the  [View Ing. Restrict.] button at the top right.  This allows you to put any minimum and/or maximum restriction on each ingredient for each diet.  Save these when exiting.  To block the use of an ingredient, put a value of =1 on the maximum restriction for that diet.  If there is no restriction, put zeros or leave the cell blank and the program will assign zeros to that ingredient for that diet.

We can enter nutrient restrictions the same way.  Click on the [Show Nutrient Specs] button and that window will open.   You can make any changes on this grid and save them before leaving it.  Also, any changes that you make on the nutrient grid of the [Current Flock] tab will be recorded as a minimum.  So, if you change the energy value of the third diet from 3050 to 3070, it is recorded as a minimum in the least cost program.

Whether you have a matrix loaded or not, clicking the [Current] button evaluates the current values on the Tab.  The expected feed conversion and Final Age are displayed.  If there are matrix data, the formulations are displayed in the second grid.   Double clicking on any cell of the grid or text on the left side of the grid will result in getting additional data.  Double click on Flock Final Weight and the program will tell you the weight of males and females, if the flock is mixed and the average gain per day

expected.  Double click on Flock Feed Conversion and the calories consumed and the cost per unit energy is displayed.  Double click on Final Age and the day of change is shown for each feed.  Click on the Nutrient Grid and more data are shown.  Click on an Energy value and the current restrictions are shown, as well as the cost of that restriction.  Click on [More Information] and the sources of energy in that diet are shown with the percentage of the energy that comes from each ingredient.

On the menu line (Files   Load Least Cost   Set Values …..) line across the top of the Main Window, you can see the live weight and feed intake by day for males and or females, see the carcass content expected for the flock, introduce such things as flock splitting and thinning, diet dilution (adding a single ingredient at the farm to the formulated feed) such as wheat that is added in the UK.  These can be useful, when needed.

## Optimization Tab:

If the matrix values are input, the program can find the least cost feeding program for a flock.  The least cost program finds the least cost way to formulate a feed to a set of restrictions.  This calculation searches a large number of diets to find the least expensive feeding program (feed weight, energy and protein/amino acids that give the lowest cost way to meet your feeding objectives.

The easiest way to do this is go to the Optimization Tab, after running the [Current Calc] button.  The target weight and number of diets will automatically transfer.  You can change these if you wish.  Click on [Transfer Diets from Current] and the program will bring in the current diets as the "Current" values of the Optimization Grid.  It will also suggest minimum and maximum values for you, if you wish.  You can let the program create the values and then alter them, as a short cut.

You can open a saved Optimization Specifications file, if you wish.  This will open a set of diet minimum and maximums you have already saved.

To run the optimization, consider what the minimum and maximum values of feed weight, energy or protein/amino acids you would consider feeding.  This is important because the optimization will likely end at one or more of the minimums or maximums you choose.  The existing ingredient restrictions will be used and the existing nutrient restrictions will be used unless changed on the grid.  When protein is changed, all amino acids are changed by the same percentage.

If you want to preserve a diet or a single value in a diet, click on the box in the Optimize column.  If the box is unchecked, the restrictions will not be changed from the original.  Often, if one is happy with the first diet, removing it from the optimization is a good idea.  It is fed in small amounts (low cost) and often is a critical step in starting the birds.  You can try optimizing that step and then not allowing it to change to see the amount of impact it might have.

The [Run Opt.] button causes the program to start the evaluation.  It can take some time and often runs over 1000 least cost diets in the brief period that it runs.  It results in a new window that shows the outcome of the optimization.  You can see the old cost and new cost, old feed conversion and new, old diet values and the recommended values, for each diet.  On the right hand side of the grid on the

Optimization Results window, you see the impact of individual change.  That is to say that the program displays the lowest cost single change that can be found for changing energy in a single diet while making no other change.  Sometimes, one can find a single change that gives significant savings.

There are four conditions that can be set on optimization.  We can set an exact feed conversion that we want in our result.  We can ask for the least cost at a set feed conversion or lower value on the same box.  We can optimize the amino acid restrictions.  This is done by cost only (and the results are often uncomfortable for the user).  Carcass composition is often degraded by optimizing amino acid restrictions as well.  We can set a preference for a particular carcass part, like white meat or dark meat (also not a great option but an option).  Lastly, we can set a specific age that we want the flock to reach the target weight or set a last diet withdrawal time, in days.

Usually, people want to preserve the feed conversion they have.  So, click on the box next to Set Feed to Gain, and the window will open that asks you to enter the feed conversion value you want.  You can let it search for low cost options at lower F2G values (a good idea).  I usually like to enter a f2g value just above the current value that is seen in the field.  It is hard to measure a difference between 1.86 and 1.87, so we might as well look at values up to 1.87.

For a nutritionist, the best way to prove that the program works is to find a set of diets that give the same feed conversion as one is seeing in the field and has a lower cost.  One cannot argue that no savings resulted if the feed conversion is the same and feed cost less.

The optimization window that opens has several tabs, one can see the summary of the optimization with costs.  One can also see the diet formulations and diet minimum/maximum for nutrients and minimum/maximum values set on ingredients.  These minimums and maximums for ingredients are not changed during optimization.  Only the minimums for energy and protein/amino acids are changed during optimization.

## Graphics:

There are several plotting actions that can help with planning a feeding strategy.   Two are started by clicking buttons along the bottom of the Current Flock Tab.  [Plot Daily] shows a plot of the daily intake of any nutrient that is tracked by the program.  Cost per day is also tracked.  Sometimes, it is surprising how much the daily intake of a nutrient is changed when feed is changed.  Calcium and Phosphorus are hard to maintain as well as one might like.

The second one is [Plot Current Feed].  This action will plot the feed conversion and age to the final weight for changes in each diet for about 100 kcal /kg below the current value to 100 kcal above and 10 percent less protein and the amino acids restricted to 10 percent above.  If the LP Cost is selected, the costs of these diets are also plotted.  Each box on the plot can be clicked to display the values used.  The current diets are always the middle point of the plot.   If a point is of interest, it can be transferred to the Current Flock Tab.

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One usually sees the largest impact of the diet fed with the highest weight. Pay attention to the range of results shown below the plot. Sometimes the range is small. The range is the lowest and highest values seen in the data collected. The grower diet is shown below. It has a wide range of outcomes.
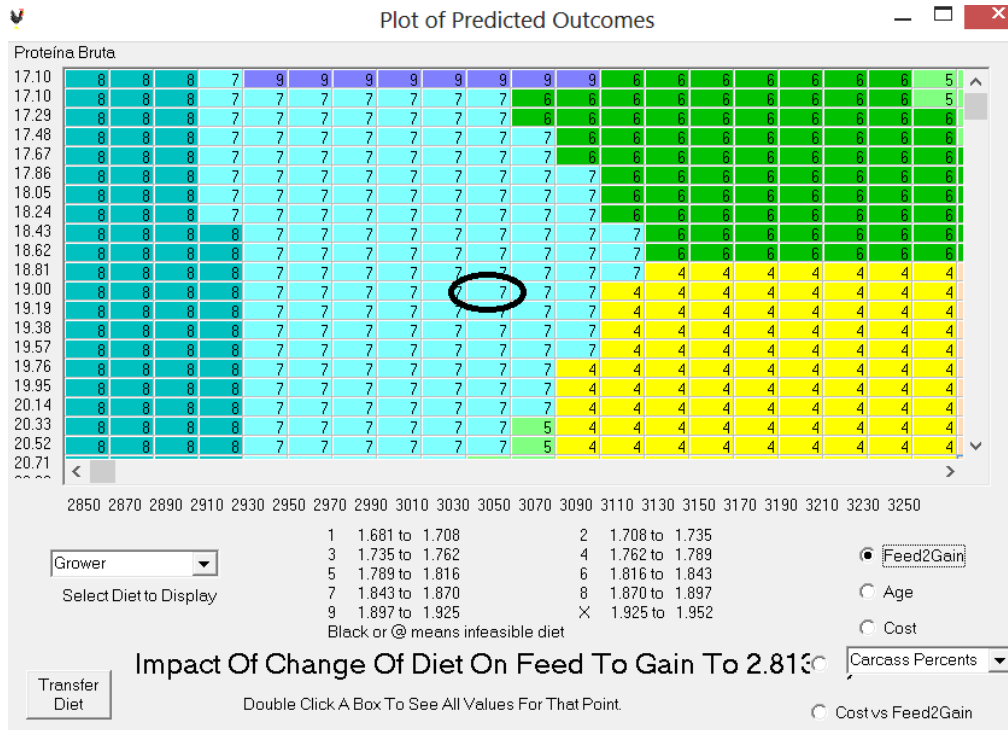


Note that the center is the starting values of 3050 kcal/kg and 19 % protein. Changing the energy higher improves the feed conversion. Increasing protein improves feed conversion, as well. We started with a feed conversion of 1.765 and can go as low as 1.681 with changing only the grower diet. This affects age