

# Decision Support System Program for Dairy Production and Expansion

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## Overview

This dairy expansion decision support tool (DE-DSS) is designed to help dairy producers explore “what-if” situations as they predict changes in dairy production and expansion. Dairy producers using the tool are able to forecast changes in herd structure for all calves, heifers, and cows. Together with the herd structure, changes in key Income Over Variable Costs (IOVC) are predicted for better decision-making from a financial standpoint. Predictions are made for up to 55 months in the future.

***The process starts by defining a period of time, the herd structure, and a set of market conditions. Then, the procedure continues by evaluating different growth or management strategies to determine their effect on the economic bottom line.***

Although the inner workings of the program are complex, the DE-DSS has been developed with the end-user in mind by utilizing a standardized format with intuitive, user-friendly commands. The DE-DSS outputs will automatically update as new information (inputs) is entered into the appropriate areas. The accuracy of forecasts is dependent upon the quality of inputs received from the user. Additional documentation and full support is available on the web at the UWEX Dairy Management Website under the “Management Tools” section:  
<http://www.dairymgt.uwex.edu/>.

## General Program Operation

### Inputs

There are a number of inputs that must be entered to make this program run properly. The number of inputs needed translates to more accurate results for the end-user. We realize not all users may be able to generate necessary input values and consequently, benchmarks for Wisconsin dairy farms are pre-loaded in input boxes where appropriate. These values should only be used if farm-specific data cannot be entered or if the user finds those figures appropriate.

### Input Cells

Each box designated for input information is green with a thick border around it:

and these are the ONLY areas where you should enter information.

## Drop Box Selection Cells

Each box designated for selecting pre-defined information, e.g., production defined by RHA level (lb/cow/yr)  .

## Information Boxes

Some cells have small red triangles in the upper right hand corner: **Heifers Sold** . By placing your cursor over one of these boxes, you will reveal an information box tied to that cell. The figure below depicts a sample information box. The information boxes provide supporting details relevant to each cell or group of cells within a nearby row or column.

<b>Cost to Raise Heifers</b>						
<b>Extra Heifers Purchased</b>						
<b>Heifer Purchases (Costs)</b>						
<b>Heifers Sold</b>						

Enter the number of heifers to be sold in the appropriate month(s).

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## Operating Tabs

All program operations are conducted from five tabs or spreadsheet pages (located at the bottom of the computer screen); each tab is appropriately titled for the information it contains. All inputs relating to cows in their first lactation can be found in the “Lactation #1” tab, for example. There are separate tabs for cows in their second and third lactations. The remaining initial inputs are found throughout the “Final Summary” page. Here, all general farm inputs, loan schedules, and specific heifer descriptors are entered into the program. The “Sensitivity Analysis” page contains input cells used to evaluate changes in specific areas once all initial input cells have been filled. ***It is recommended that you begin with the “Lactation #1” tab and work your way logically to the “Final Summary” and “Sensitivity Analysis” when entering information.***

## Outputs

### Final Summary

The “Final Summary” tab is your destination for general farm input information. Input cells on this page allow you to enter information related to milk price and feed cost, as well as any animal purchases or sales. This page also contains several **program outputs**. Here, you will find monthly summaries for cows separated by lactation number and a complete whole-farm

summary. Key figures, such as Net Present Value (NPV) and IOVC, are generated to provide solid supporting evidence. ***The outputs in the “Final Summary” are to be used only if no information is evaluated in the “Sensitivity Analysis”.***

### **Sensitivity Analysis**

Once all available input information has been entered, the “Sensitivity Analysis” page offers an opportunity to explore many “what-if” situations. You can quickly evaluate how changes in milk price, total farm expenses, milk production, and cull rates will impact monthly cash flows. A flexible framework allows each input to be evaluated individually or with others at the same time. You may define both the quantity and the month when each change will take effect. Relevant output information is summarized in the same format as the “Final Summary”. ***The information contained in the “Sensitivity Analysis” page should only be used if one or more changes regarding milk price, total farm expenses, milk production, and cow cull rates are evaluated.***

### **Income Over Variable Costs**

Income Over Variable Costs (IOVC) is calculated on a monthly basis for each lactation group and on a whole-farm perspective. These numbers are useful to identify changes in cash flows within any scenario. Included in this calculation are:

+	Milk Income (a function of milk production)
-	Loan Amortization (weighted according to monthly herd structure)
-	Feed Cost (a function of feed intake)
-	Labor Cost (a function of milk production)
-	Cost to Raise Heifers
-	Miscellaneous Expenses
+/-	Livestock Income/Costs (heifer sales/purchases & cull cow sales/losses)
=	Income over Variable Costs

### **Net Present Value**

The Net Present Value (NPV) analysis is located within rows 78-83 on the “Final Summary” page and within rows 117-122 on the “Sensitivity Analysis” page. If comparing two or more separate scenarios, the projected values in the Net Present Value Analysis Summary are very important to consider when making a final decision. Imagine evaluating two different heifer purchasing strategies to aggressively grow a herd: 1) Purchase 20 heifers in month 4 of a 16-month expansion phase. 2) Purchase 40 heifers in month 15 of the expansion phase. The Total Net Present Value will indicate which purchasing strategy is most advantageous from a financial standpoint. A higher NPV is always desirable; other factors regarding management, housing, practicality, etc. should also receive consideration before a final decision is made.

### **Printouts**

The “Printouts” page is your final destination for information. All relevant program outputs are summarized and compiled into a printer-friendly format. **Be sure to print documents from the “Printouts” page in LANDSCAPE orientation.** Here, you have the opportunity to compare changes in herd structure, monthly cash flows, and NPV based on information entered in the “Sensitivity Analysis” page.

## Detailed Instructions for Operation

1. To begin using the program, click on the tab labeled, “Lactation #1”. Enter specific farm input values in the designated input boxes in column E. The “Inventory” boxes ask for the number of 1<sup>st</sup> lactation cows within each month in milk group.
2. Scroll further down below and select your herd’s Rolling Herd Average (RHA) in cell E41. A menu is provided to the left to help you enter the correct number (2-14).
3. Enter cull rate information for 1<sup>st</sup> lactation cows (0-60 DIM) and (61-330 DIM). The cull rates are divided by the number of months within each time period. A cull rate is also included for the dry period.
4. Finally, enter the number of heifers that will be calving or have already done so in the current month.
5. Repeat steps 1-3 for cows in their 2<sup>nd</sup> and 3<sup>rd</sup> and higher lactations via “Lactation #2” and “Lactation #3” tabs.
6. Select the “Final Summary” tab. Enter information in the designated boxes under the “General Information”, “Cattle Purchasing & Sales”, “Loan Amortization”, and “Raised Replacement Heifers” sub-headings.
7. To evaluate heifer purchasing/sales strategies, scroll down to rows 68 & 70 and begin in column “H”. Enter the number of heifers to be sold or purchased within each month. **Note: All purchased heifers are assumed to calve within the month they enter the program.**
8. Finally, enter the desired NPV discount rate in cell I78.

***At this point, you may choose to evaluate changes in milk price, total farm expenses, milk production, and cow culling rates. If so, continue on to steps 11 & 12. If you do not wish to evaluate any criteria in the “Sensitivity Analysis” page, complete steps 9 & 10.***

9. Select the “Sensitivity Analysis” tab. Make sure the amount listed in cell E6 matches the amount shown in cell C6. If these numbers are not equal, enter the correct amount in cell E6.

Likewise, the amounts in cells E9 and C9 must be equal. If these numbers are not equal, enter the correct amount in cell E9. Finally, glance at the input cells for milk production and culling rates for lactations 1-3 in column E. Be sure all boxes show values of "0". Make any corrections as necessary in the designated cells.

10. Look carefully at the results and make an informed decision! Printer-friendly summaries are located in the "Printouts" page. To print, select the "Printouts" tab. Then, from the Excel menu, select "Print" → "Print Preview" → "Page Setup" and choose "Landscape" orientation.
11. Select the "Sensitivity Analysis" tab. Changes in milk price, total farm expenses, milk production, and cow culling rates may be evaluated either individually or together in any combination. Enter the new quantity or quantities to be evaluated in the appropriate boxes found in column E. For each new quantity entered, you must enter the month number when the specified change in quantity is to be applied. The input boxes in column G specify when each change occurs in the program.
12. Once the appropriate entries have been made in the "Sensitivity Analysis" page, your simulation is complete. Follow step #10 to analyze and print the results.

## Working Modules of the Spreadsheet

Besides the five pages designated for user interaction, there are ten others (Forecast Sheet, Forecast Sheet (2), Loan Calculator, RHA Data, Projected DMI & Feed Cost, Labor Cost, Milk Income, Heifers, Culling, and Sensitivity Analysis Tables) which contain a wealth of supporting information. A number of data tables are contained within these pages which support vital program calculations and functions. Below is a brief description of how each page contributes to overall program function:

### Forecast Sheet

The "Forecast Sheet" tab gives a complete picture of how herd structure changes over a period of time. **No information needs to be entered in this page – it is a visual reference of how the program works.** The figure below depicts the stepwise movement of a group of 1<sup>st</sup> lactation cows from one month in milk through four months in milk:

1	Milking	Open	11	20	20	20
2	Milking	Open	6	10	19	19
3	Milking	Open	6	6	10	19
4	Milking	Open	6	6	6	10
5	Milking	Pregnant	6	6	6	6
6	Milking	Pregnant	6	6	6	6
7	Milking	Pregnant	6	6	6	6
8	Milking	Pregnant	6	6	6	6
9	Milking	Pregnant	6	6	6	6
10	Milking	Pregnant	6	6	6	6
11	Milking	Pregnant	6	6	6	6
12	Dry	Pregnant	6	6	6	6
13	Dry	Pregnant	6	6	6	6

In this case, there are 11 cows 1 month in milk.

In month 4 of the lactation, there are 10 cows remaining in the original group.

### Forecast Sheet (2)

“Forecast Sheet (2)” operates when any information is entered into the “Sensitivity Analysis” input boxes. This allows for useful comparisons between herd structure and cash flows when evaluating potential changes in milk prices, total farm expenses, milk production, and cow culling rates. Aside from this, the information contained within “Forecast Sheet (2)” follows the same principles as the original “Forecast Sheet”.

### Loan Calculator

The loan calculator improves accuracy of forecasts generated by taking into account large capital purchases. Oftentimes, when a dairy herd is expanded significantly, investments in farm infrastructure are necessary to effectively manage more animals. Five inputs connected to cells in the “Final Summary” allow for accommodations to several different loan schedules. Whether the payments are monthly, quarterly, yearly, or otherwise, a payment is assessed to each lactation group and is part of the IOVC calculation. The total payment per group is weighted based on the ratio of cows in that specific group to total cows in the herd. For example, if cows in their first lactation comprise 30% of the entire herd, then 30% of the total loan payment per period will be charged to first lactation cows.

### Rolling Herd Average (RHA) Data

You are able to input the average milk production of each lactation group. The sum of the milk production of all cows in each month reflects the monthly RHA. Each cow’s stage of lactation is matched with her expected production in that stage and monthly production figures are produced for each lactation group. The original milk production data came from a database containing over three million cow records provided by AgSource Cooperative Services

(AgSource.com). Wisconsin lactation curve benchmark data utilized in this program were created by the UW-Extension Dairy Management Team and are available at: <http://www.dairymgt.uwex.edu/tools.php>.

### **Projected Dry Matter Intake (DMI) & Feed Cost**

Dry Matter Intake levels for cows in each lactation group are calculated based on the level of milk production defined by the user through the RHA. Using the milk production benchmarks as a guide, DMI's are scaled to 4.0% fat corrected milk according to methods outlined by the National Research Council (2001). Feed intake figures are applied to the program in a fashion similar to the RHA Data. Once monthly feed intake levels are established, a user-defined price per pound of dry matter is employed to calculate feed costs.

### **Labor Cost**

According to 2007 AgFA data supplied by the Wisconsin Center for Dairy Profitability ([cdp.wisc.edu](http://cdp.wisc.edu)), there are nearly 950,000 lbs of milk sold per full-time equivalent. A full-time equivalent constitutes 2,860 labor hours per year – this equates to roughly 332 lbs of milk sold per labor-hour. Program users are able to input their own labor costs on an hourly basis. Finally, pounds of milk produced are divided by each full-time equivalent and multiplied by the labor cost per hour.

### **Milk Income**

Milk income is directly dependent upon milk production levels. All milk production data in the program is converted to hundredweights and then multiplied by the user-defined milk price.

### **Heifers**

There are significant costs associated with raising heifers before they calve and begin their first lactation. Benchmark data for daily costs associated with raising heifers was obtained from a 2007 Wisconsin statewide survey performed by the UW-Extension Dairy Team (<http://www.uwex.edu/ces/heifermgmt/documents/ICPAfinalreport.pdf>) and is available for reference. However, users are able to input their own heifer rearing costs. Calf and heifer growth is tracked from birth to 24 months. Daily costs are appropriately scaled to a monthly basis and then multiplied by the number of heifers in each stage of growth.

The "Heifer" page also contains tables that control how user-defined heifer cull rates are applied. Cull rates are converted to a monthly percentage, which is multiplied by the number of animals within each stage of growth.

## **Culling**

Culling rates for cows (0-60 DIM, 61-330 DIM, and dry period) are applied in a manner similar to heifers. User-defined inputs are divided to reflect the monthly culling risk for every cow in the herd. According to AgSource Wisconsin benchmarks, about 25% of culling events are due to mortality. By default, temporary income is generated for cows that are culled (75% of user-defined culling rates). Death does not generate any income.

## **Sensitivity Analysis Tables**

The tables found in the “Sensitivity Analysis Tables” tab support actions directed by “Sensitivity Analysis” inputs. Each table is closely linked to like tables in other working modules of the program. For example, the milk production sensitivity analysis tables operate in the same way as those found in the “RHA Data” tab.