



Income Over Feed Supplement Cost (IOFSC®)

Fact Sheet and Instructions of Use

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The Income Over Feed Supplement Cost (IOFSC®) is an Excel application designed to help producers, consultants, and extension agents compare and select feed supplements in diets of lactating cows. The spreadsheet (1) maximizes the Income Over Feed Supplement Cost (IOFSC) for a user defined amount of forage in the diet and (2) graphs the IOFSC to visualize the substitution of two selected feed supplements.

1. Make IOFSC® work in your local machine

1.1. Prepare Excel

Open a clean copy of Excel on your computer

- Excel 2003:**
- a) Tools/Macro/Security... Select **Low** Security level
 - b) Tools/Add-Ins... if not checked, check **Solver Add-in**, then OK
 - c) Tools/Solver (make sure solver opens in your spreadsheet)
 - d) close Solver. Your Excel 2003 is ready.

- Excel 2007:**
- a) Ribbon (upper left corner)/Excel options
 - b) Trust Center/Trust Center Settings/Macro Settings/
 - c) Select **Enable all macros**, then OK
 - d) Add-Ins/ Manage: **Excel Add-Ins Go...**
 - c) If not checked, check **Solver Add-in**, then OK
 - d) Add-Ins/Solver (make sure solver opens in your spreadsheet)
 - d) close Solver. Your Excel 2007 is ready.

1.2. Download and extract the application from the Dairy Management Website

- a) Open a Web browser and visit the dairy management website at:
<http://www.uwex.edu/ces/dairymgt/>. (Hint: if you are seeing this in a web browser, you can copy and paste the link to a new web browser to keep this document open.)



- b) Select Management Tools on the left menu
- c) Under the title Income Over Feed Supplement Cost, click on [IOFSC.exe](#) File
- d) Save the executable file in a known location in your local machine
- e) Double click in the file [IOFSC.exe](#) you just saved, select Run
- f) In the WinZip Self Extractor window, the driver "C:" will appear as default, but you could click on the Browse button to save the files in any other directory of your computer. Click Unzip and a message will appear: "4 files were extracted successfully." Click OK.
- g) Locate the folder where you extracted the files. Open folder and open the file with name: **IOFSC.xls**.
- h) For **Excel 2003** users: In the event that a **Security Warning** window appears asking to Disable or Enable Macros, select to **Enable Macros**.
- i) For **Excel 2007** users: In the event that a **Security Warning** appears in the top of the spreadsheet, click on the **Options...** button provided by this warning, select **Enable this content** and click OK.
- j) Congratulations: your application is ready to be used, continue below.

2. Work with the IOFSC®

2.1. General recommendations

- a) Notice that the spreadsheet is divided in 10 sections'
- b) In each section, cells marked in yellow are input data that can be overwritten as desired. Drop box menus and option button selections are also for personal choice. Cells in blue are output data where you will see results, but you are not allowed to change because they may include formulae.
- c) The large blue button in Section 6 labeled "Maximize IOFSC" and the large red button in Section 7 labeled "Perform a Substitution" are "action" buttons that will perform the analysis after data entry is completed.
- e) At the end of each printable page there is a gray button labeled "Print this Page." By clicking on them you will prompt the printing of the specified page. Each page is formatted to print in a letter size (8" x 11") paper of sheet.



2.2. Select appropriated units

Your first selection should be for the "units" of your preference. You can select either "Metric" or "English" units by clicking in the appropriate option button in the right upper corner of the spreadsheet.

2.3. SECTION 1: Calculate Dry Matter Intake (DMI)

The dry matter intake (DMI) is calculated according to NRC (2001): Equation 1-2 (pg. 4) using your inputs for milk production (MP), body weight (BW), and days in milk (DIM). The resulting DMI is displayed in the blue cell in Section 1.4.

Example: The DMI of a milking cow 180 days in lactation, weighting 1380 lb, and producing 110 lb/milk/day is calculated at 67.53 lb/day.

2.4. SECTION 2: Set the Sources and Proportion of Forage in the Diet

In this section you need to input the percentage of forage in the diet on a dry matter basis. Then, you have the option to select up to three different forage sources (from seven potential sources) and input their relative proportion. The sum of these three forage sources have to add to 100%. A warning will appear when this summation is different than 100%.

The amount of crude protein (CP), rumen degradable protein (RDP), and rumen undegradable protein (RUP) provided by the selected sources and proportion of forages in diet is calculated by using the nutrient composition of feeds from the NRC (2001): Table 15-1. The fractional rate of passage (Kp) in the calculation of RDP and RUP for single forage inputs are based on the previously calculated DMI and the input BW.

Example: A diet containing 50% of forage, of which 50% is corn silage and 50% is alfalfa silage will provide 5.18 lb of CP in the diet.

2.5. SECTIONS 3 & 4: Set the Energy, Protein and Byproduct Supplements in the Diet

Three main supplements for energy are considered relevant for Wisconsin conditions: corn grain ground dry, barley grain rolled, and wheat grain rolled. Similarly, eight supplements for protein/byproducts are considered: soybean meal solvent 44% CP, corn gluten meal dried, corn gluten feed dried, corn distiller grains with soluble dried, soybean seeds whole roasted, soybean meal expellers 45% CP, blood meal ring dried, and urea. Note that in the spreadsheet supplement composition are according to Table 15-1 of NRC (2001). Numbers before the name of the supplements correspond to numbers in Table 15-1 of NRC (2001).

In both sections you need to define the price and the upper limit for each feed supplement. The upper limit is the maximum of a feed supplement to be in the diet. For example, you could limit the amount of corn grain to 15 lb or the amount of blood meal to 1 lb. As an option, you can



enter the amounts of supplements in the current diet. If you do so, the spreadsheet will give you the opportunity to compare the actual IOFSC with the optimized one.

If you wish to exclude a supplement from your analysis, either write zero (0) or leave blank the upper limit cell.

As in the case of forages, RDP and RUP for each of these feed supplements are calculated with standard NRC (2001) equations (pg. 46 and 61) using the Kp according to DMI and BW.

2.6. SECTION 5: Set the Upper Limits for RUP, RDP, and Milk Price

You need to define an upper limit (maximum percentage) for RDP and RUP in the diet. As the default, these limits are set to 7 and 12%, respectively in Sections 5.1 and 5.2, respectively.

Finally, you need to enter the milk price to be used for the analyses in Section 5.4.

Congratulations! you have entered all data needed to perform the optimization analysis.

2.7. SECTION 6: Perform Optimization, Maximize IOFSC

To perform the IOFSC optimization analysis, you need to click on the large blue button labeled: "Maximize IOFSC."

After clicking on it, you will find the optimal amounts of selected supplements in the blue cells in Sections 3 and 4, the final RUP, RDP, and consequently final CP in the blue cells in Section 5, the expected milk production, and maximum IOFSC in Sections 6.2. and 6.3, respectively.

If you have entered current amounts of feed supplements in the diet, you can compare expected milk production and IOFSC with the optimized values.

Expected milk production is different than entered milk production depending on final calculations of RDP and RUP provided by the forages and feed supplements. Following NRC (2001) equation (pg. 50), calculated milk production = $-55.61 + 1.15 * \text{DMI} + 8.79 * \text{RDP} - 0.36 * \text{RDP}^2 + 1.85 * \text{RUP}$. Because the amount of forages is fixed, milk production responds to changes in sources and quantities of feed supplements.

The IOFSC is calculated as the difference between the revenue of milk produced and the costs of the feed supplements on a daily basis: $\text{IOFSC (\$/cow/day)} = \text{MP} * \text{Milk Price} - \sum_{i=1-N} (\text{Feed}_i * \text{Feed Cost}_i)$ for N feed supplements included in the solution.

The maximization of IOFSC is obtained subject to the constraints of: 1) limits imposed on upper limits percentages of RDP and RUP, 2) upper limits specified for each feed supplement, 3) amount of feed supplements to equal the required DMI, and 4) non-negativity of coefficients to be selected.

Example: Setting the price (\$/bu) and the upper limit (lb) of the energy supplements to: corn (4 & 15), barley (4.8 & 0), and wheat (7.4 & 10); the price (\$/ton) and the upper limit (lb) of the protein/byproduct supplements to: soybean meal (250 & 15), corn gluten meal (550 & 2), corn gluten feed (160 & 10), corn distiller grains (200 & 10), soybean whole roasted (318 & 7), soybean meal expellers (402 & 15), blood meal ring dried (900 & 1), and urea (635 & 1); and the upper limit for RUP and RDP at 7 and 12%, respectively, the maximum IOFSC is \$15.33/cow/day producing 101.84 lb/milk/day using 15 lb of corn, 4.23 lb of soybean meal, 0.19 lb of corn gluten meal, 4.34 lb of corn gluten feed, and 10 lb of corn distiller grains.

If the current diet would contain 10 lb of corn, 5 lb of barley and 10 lb of soybean meal as supplements, the IOFSC would be \$12.96/cow/day producing 85.71 lb/milk/ day.

Now that we have an optimal diet, we can explore the impact of changing prices or changing feed supplements in the diet.

2.8. SECTION 7: Perform a Substitution Analysis

As you start using Section 7, additional information and data entry are required. This section displays the marginal IOFSC in response to substituting one of the energy supplements for one of the protein/byproduct supplements.

You need to define the energy and protein/byproduct to be dynamically substituted. For example, you can elect to substitute corn grain for soybean meal.

You can also change prices for either the energy supplement, the protein/byproduct supplement, or the milk. These changes are defined in Section 7.3.a by selecting the appropriated option button: Energy, Protein, or Milk. Additionally, in Section 7.3.b, you can define a price range set by a upper and a lower limit. These percentage changes are calculated with respect to the price previously defined in the application. You can define the upper and lower price limits by typing directly the percentage values in the yellow cells and/or by using the provided arrow up or down buttons to increase or decrease the values.

Example: if you set in Section 7.2 the protein supplement to be soybean meal, then in Section 7.3.a the change in price to be for the Protein, and in Section 7.3.b the upper limit to be 50% and the lower limit to be 25%, you will be analyzing the impact of a change in price of soybean meal from \$375 (upper limit) to \$ 187.5 (lower limit) when the baseline price is \$250.

Once again, congratulations! you are ready to perform the substitution analysis by clicking the large red button labeled: "Perform Substitution." After clicking on it, you will be able to see two updated figures (Section 8 and 9) and an update table (Section 10).

2.9. SECTION 8: IOFSC and Milk Production when Substituting Energy for Protein/Byproducts

The figure in Section 8 has two curves: the milk production and the IOFSC, which are plotted against dietary CP (DM basis). Figure 1 below is an example obtained by substituting corn (\$4/bu) for soybean meal (\$250/ton) when milk was \$18/cwt.

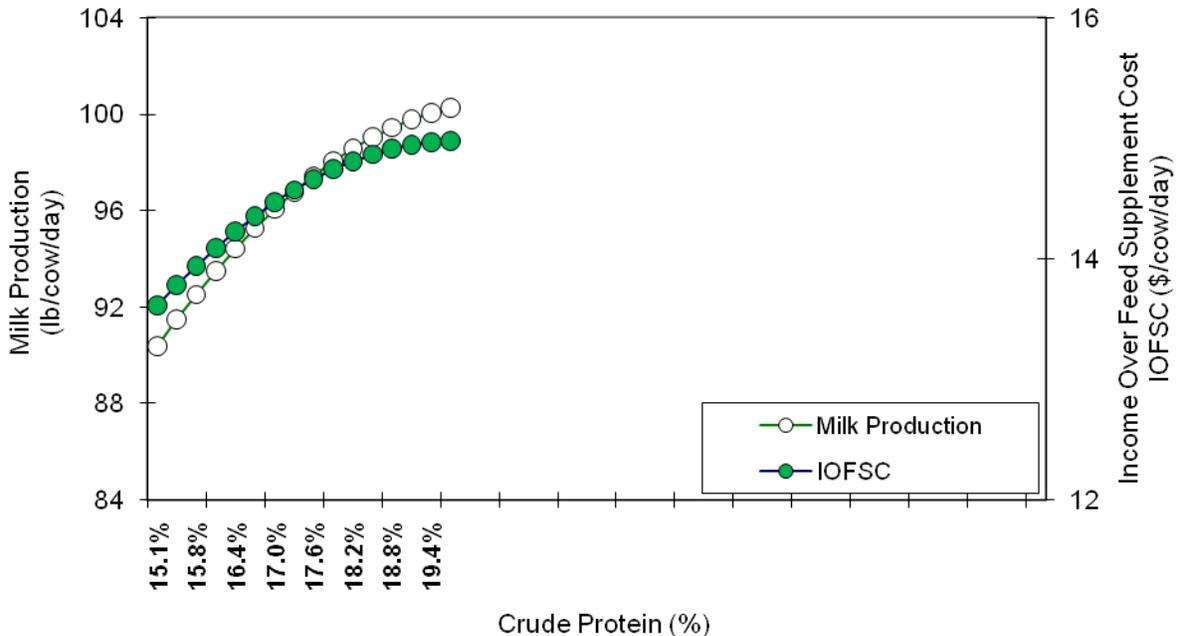


Figure 1: Change in expected milk production and IOFSC in response to change in dietary CP (DM basis) as a result of substituting corn grain (\$4/bu) for soybean meal (\$250/ton) in the diet when milk price was \$18/cwt.

Example: Figure 1 shows that milk production continues to increase as dietary CP increases above 19%, the IOFSC reaches a plateau at 19% CP. This example shows that feeding more than 19% CP may result in higher milk yield, but without additional income.

The substitution of the two feed supplements are performed by defining 70 possible iterations between the two supplements. First, all needed DM is assigned to the energy supplement. Then, at each iteration, the energy supplement decreases as the protein/byproduct supplement increases in the same quantity keeping the DMI constant. The RUP, RDP, CP, the expected milk production, and the IOFSC at different prices are calculated at each iteration, but results are only displayed for those iterations where the CP is in the acceptable range between 15 and 20%.

2.10. SECTION 9: Change in IOFSC at Upper and Lower Selected Prices

The Figure in Section 9 presents an example of the changes in IOFSC as a result to substituting corn (\$4/bu) for soybean meal (at different prices) when milk was \$18/cwt. The different prices for soybean meal were defined in Section 7.3.b as a upper price of \$375/ton (50% above price base of \$250/ton) and as a lower price of \$187.5/ton (25% below the price base of \$250/ton).

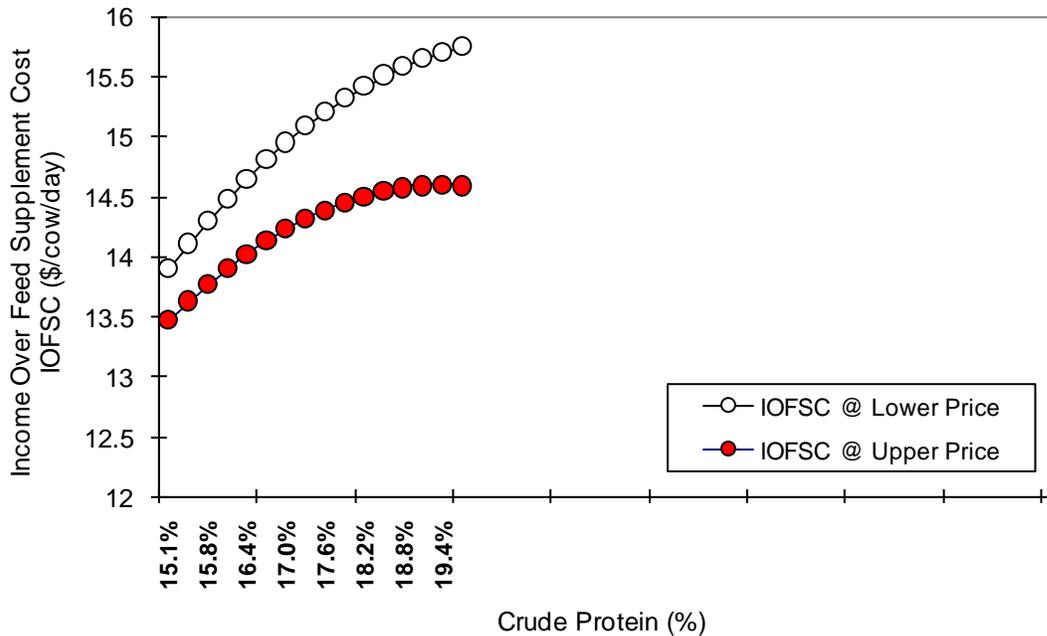


Figure 2: Change in IOFSC in response to change in dietary CP (DM basis) as a result of substituting corn grain for soybean when soybean meal price is \$375/ton (Upper Price) and when soybean meal price is \$187.5/ton (Lower Price) .

Example: Figure 2 compared with Figure 1 shows that the IOFSC in response to the substitution of corn grain for soybean meal will reach a plateau earlier when soybean meal price increases and later when soybean meal price decreases. Consequently, lower CP levels may be justified when the price of soybean meal is expensive.

2.11. SECTION 10: IOFSC and Milk Production when Substituting Feed Supplements and Changing Selected Prices

Tabulated data of the substitution analysis is presented in Section 10. The "Energy" refers to the supplement for energy selected in Section 7.1, the "Protein" refers to the supplement for protein/byproduct selected in Section 7.2. The "Milk" is the expected milk produced. The IOFSC is presented for the "base", "upper", and "lower" defined prices.



2.12. Support and Troubleshooting

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