Food and Agriculture Organization of the United Nations

FAO Ration Tool

Administrator Guide

Important: Before using the program, everyone has to update Feed Database Sheet in the Excel file. See Page 10, Section: Sheet 5

Excel settings

To use the file, Microsoft Excel has to be installed. Current version of the file has been optimized for Excel 2016 version and could run improperly on other versions.
The file contains VBA programs, known as « macros ». Please ensure your computer settings authorize you to open macros or notify you when Excel files contain such programs. To do so:

1. Click on « File » tab.
2. Then in the « Security Warning » area, click « Enable Content ».
3. Under « Enable Content », click « Always enable this document's active content ». The file becomes a trusted document.

The program uses a special add-in of Excel called « Solver ». It needs to be installed:

1. Click on « File » tab
2. Click on « Options »
3. Select « Add-ins »
4. Click « Go…» button
5. Select « Solver Add-in »
6. Validate.

You might also install the Solver program in the VBA section, or check it has been installed in that section. To do so:

1. Click on « File » tab
2. Click on « Options »
3. Select « Add-ins »
4. Click « Go…» button
5. Select « Analysis ToolPak VBA»
6. Validate.
7. Go to the « Developer » tab
8. Click on the « Visual Basic » button
9. Click on the « Tool » tab
10. Click on « References… »
11. Select « Solver »
12. Validate.

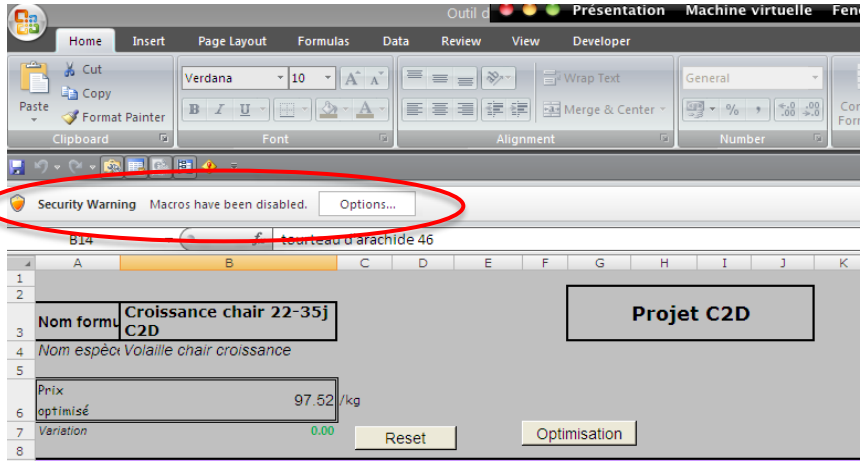
Open the file

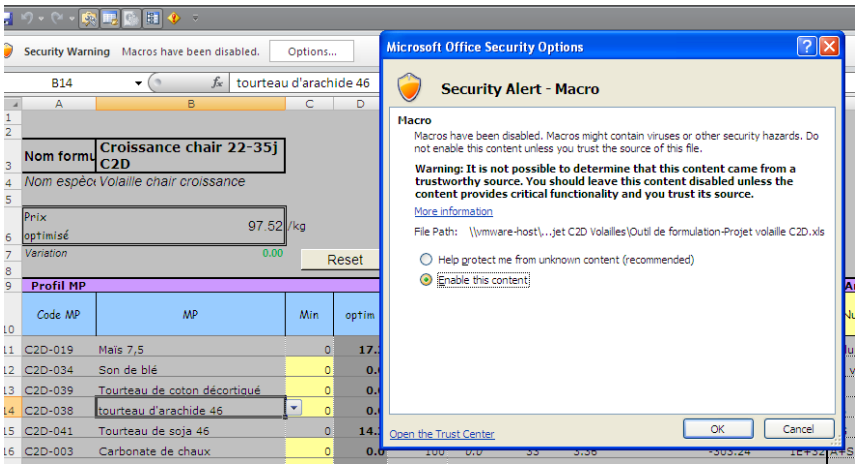
Double click on the file icon named “FAO Ration Tool.xls”
A window or a security warning should be displayed as below:

On the message bar click « Enable Content » as follows:

The following image is an example of the Message Bar when macros are in the file.

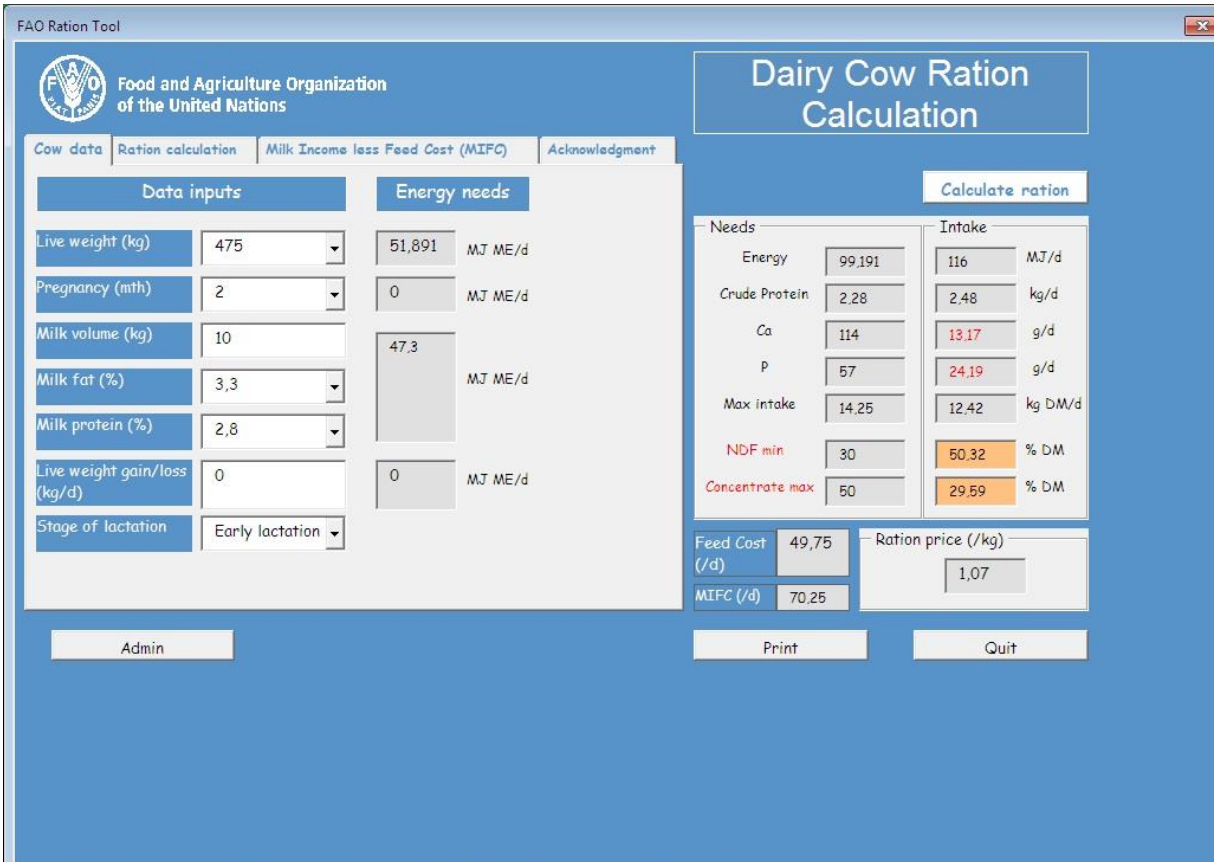
Or click on the “Option” button, and enable the content to activate macros or activate the macros directly if you’re invited to do so. If you don’t activate the macros the program will not work.





User form

After you've activated the macros, the file opens and a user form should be displayed.
If you don't see any user form and only see the Excel file, please contact your administrator who gave you the file.

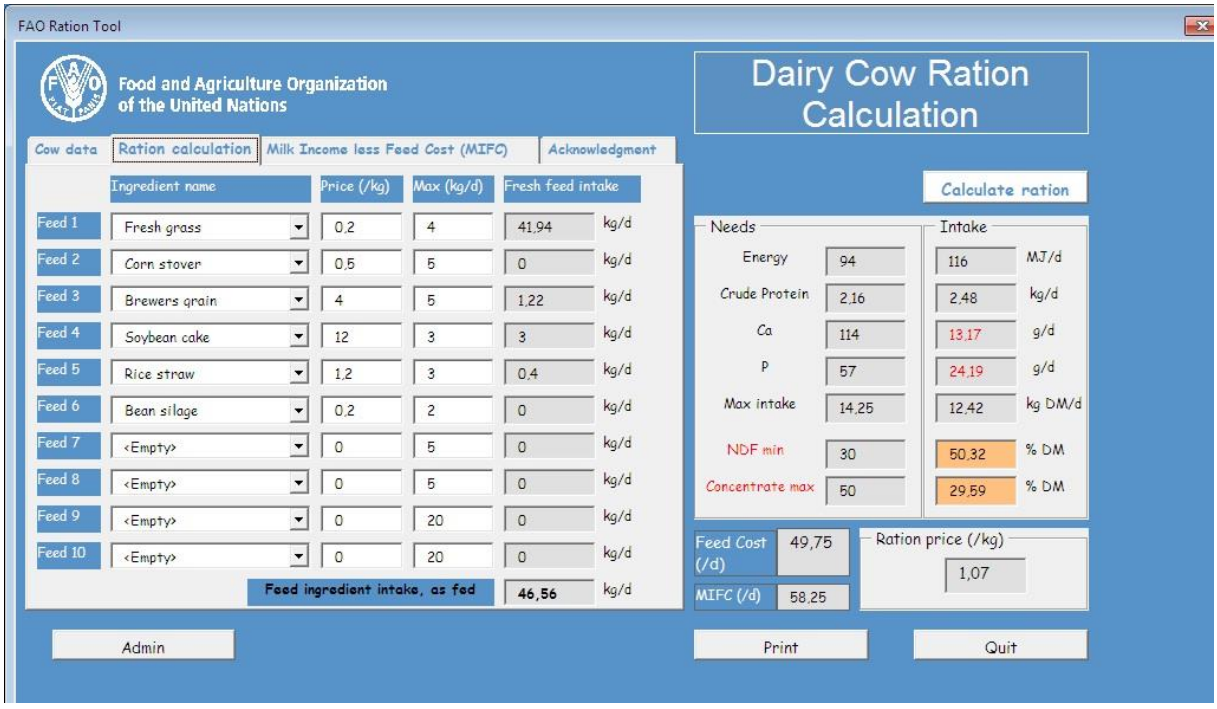


Important !
You should only work using the user form, not directly on the Excel file! If in case of error you access the Excel file, please close the file and re-open it.

User form is composed of 4 different tabs and a main information panel:

1. Cow data. This tab concerns data input about cow description and characteristics. Values in white cells can be modified. User can use the dropdown list to select the correct input or enter the value directly in the cell. Animal energy needs for each criteria are calculated and displayed automatically depending on data input; total energy need is displayed on the panel on the right of the user form.

2. Ration calculation. This tab is used to select ingredients (dropdown list), enter their prices on fed basis, and set the maximum quantities the farmer can give to his/her cow per day. If the administrator has already entered the prices in the Feed database sheet, these will be displayed by default and you might not need to change it. However, if the prices have changed, you can make the change here. Pay attention not to select the same ingredient twice. Prices are per kg and quantities are maximum available in kg per day per cow. Both these parameters are on as-fed basis and NOT dry matter basis. Nutritional value parameters (under both 'Needs' and 'Intake'; in the right-hand block) are displayed as-fed basis except NDF, Max intake and concentrate max which are on DM basis. User has to keep an eye on concentrate and NDF values and make manual adjustments on ingredients if necessary.



Attention!

Set all prices in the same currency and per kg as fed, or the calculation will be incorrect! The currency is not defined to allow user to use the currency of one's choice, but it has to be always the same.

Maximum quantities available (with the farmer) are entered in kg per day per cow under the column **Max (kg/d)**. [Note: Please do not leave any box under the column **Max (kg/d)** blank. The software might not work properly. There should be some value under this column]

Quantities of ingredients (fresh feed in kg per day) can be modified manually (even if cells are in grey color) and results are displayed automatically (nutritional analysis and price of the ration).

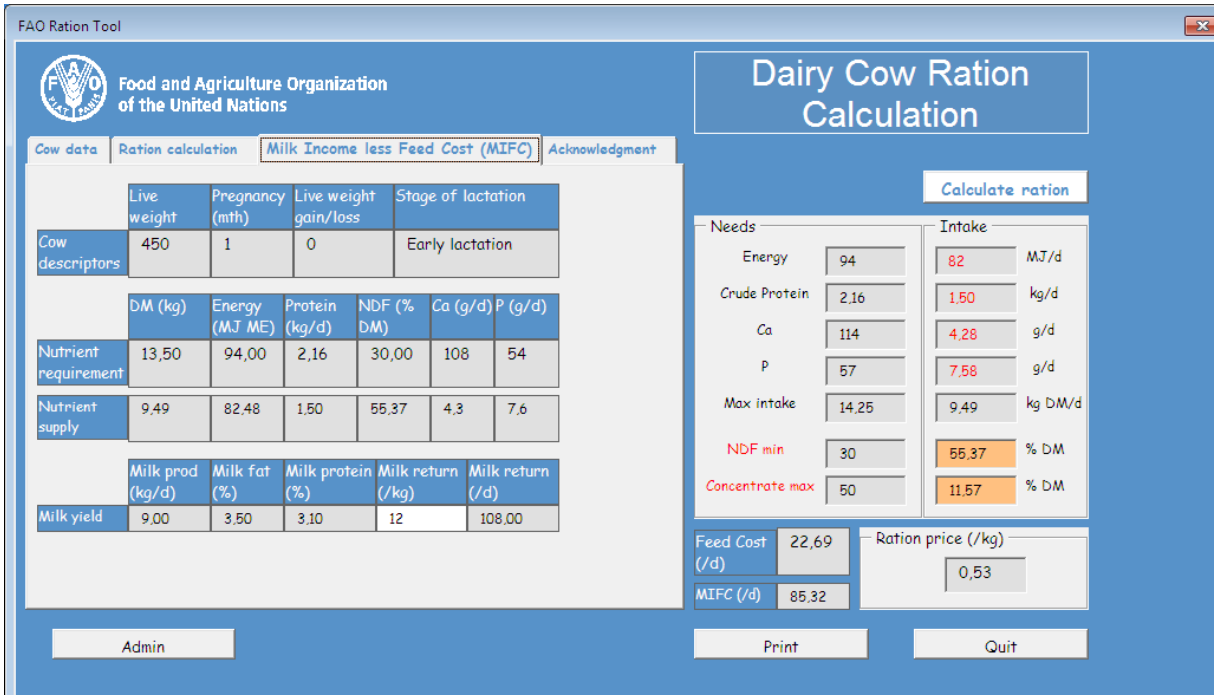
It is possible to launch the automatic calculation of a least cost optimized ration, by clicking on the "Calculate ration" button. If an optimal solution has been found, quantities of ingredient are displayed under the column "**Fresh feed intake**" and nutritional values and price are displayed. If no solutions are possible or if the calculation has encountered a problem, a warning message is displayed. [Notes: 1. If no solutions are possible and a warning message is displayed. On pressing OK on the warning message, in some cases, the software gives an approximate solution. Please note that this solution is not the optimum solution. It is the nearest solution the software has found. In such a situation you either include another ingredient under the column "**Ingredient name**" or manually change the amount of ingredient available in the column **"Max (kg/d)"** column in order to maximize the chances to get an optimal solution, and then press the button: **Calculate ration** to arrive at the optimum solution. If protein is deficient (under **Intak**e column) than the needed amount (under **Need** column], you may have to either increase manually the amount under the column **Fresh feed intake** of the already entered ingredient that is rich in protein or select another protein-rich ingredient under the column **Ingredient name,** and then press **Calculate ration** button. Same approach could be used for the energy. 2. Intake values appear in red if it is below requirement or above maximum value].

If you need to add another ingredient that does not appear in the top down menu, please contact your administrator or refer to the administrator guide.

If you have to deselect an ingredient under the column **Ingredient name**, select <empty> from the drop down menu. [As an administrator when you are entering feed ingredients, their chemical composition, price etc. in the Excel sheet: Feed database, please do not touch the <Empty> row. Do not replace <Empty> with another feed ingredient. This row (<Empty>) is vital for deselecting a feed ingredient. Also do not delete < or > sign which is before and after Empty respectively]

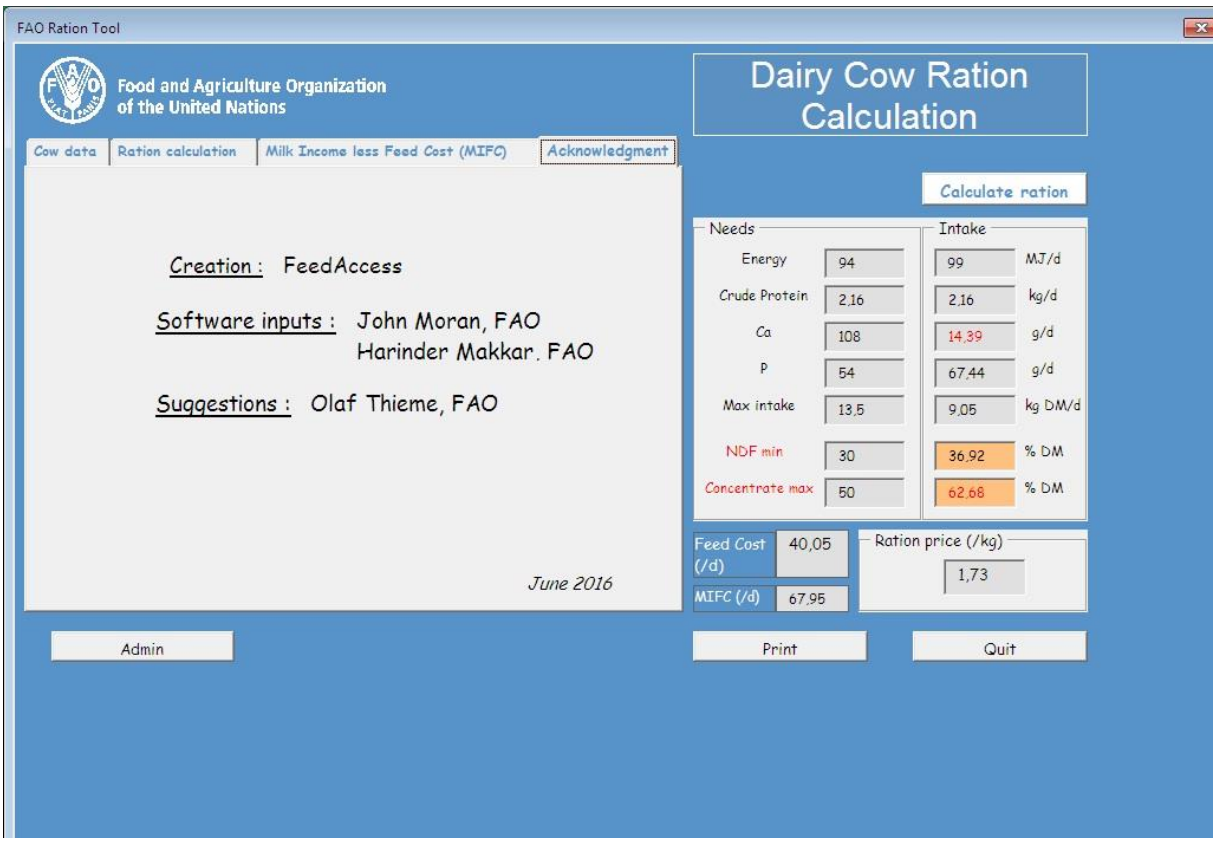
3. Milk Income Less Feed Cost (MIFC)

The tab allows user to calculate the incomes of the farmer's milk production per day. Only milk return per kg is required, the other values are calculated automatically from inputs of tabs "Cow data" and "Ration calculation".



4. Acknowledgment

The team and people who have participated to make this program are presented here.



The user form has 2 buttons available anytime:

1. "Quit" button to exit the program
2. "Admin" button to access the Excel file and change values and setting. A password is required to access this function and is reserved for administrators.

VBA Program

The administrator has access to the Excel file. The program is based on previous Excel file used to help administrator and not change his habits. However, changes can have negative impacts on the proper running of the program. The following information will guide administrator on how to operate changes safely.
Anytime the administrator can go back to the user form interface clicking the "Back to user form" button in the "Title" tab.

Attention!
Any formula change, suppression or addition of new data, column, row or cell, or format change can affect the VBA program. Please save the file under a new name before any change and keep a backup of your files. In case the file would not run properly please contact your technical services or your contact at FAO.

1. **Change values in the Excel file:**

Only blue and grey cells values can be changed!
Blue cells are values that are set by user to calculate ration. They can be changed although it it advised to do so through the user form.
Grey cells values can be changed without risk. By change means replacement. If you need to add or remove a value, formulas in yellow cells have to be adapted. These are reference values used by the program, such as energy need depending on cow's live weight, etc. Pay attention not to change its format which could affect the program.
Yellow cells should not be changed! It contains formulas that are used by the program. Any change may cause program errors.

Sheet 2: Cow req

NDF: NDF value is independent and can directly be changed.

LWT (kg): Values can be changed. If you need to remove a value, fill the first cells and keep the last cell empty. If you need to add a value, you need to modify the list created. Select the cell with the LWT dropdown list (C4) -> Go to "Data" tab -> Select "Data validation" -> Click on "Data validation" -> Modify the source from "=$F$2:$F$12" to "=$F$2:$F$13" if you want to add one value, or to "=$F$2:$F$14" if you want to add 2 values, etc. Do not forget to adapt the corresponding **ME requirement for maintenance** data and update formula in "D4".
Source values need to be changed in the VBA program in the initialization function.

ME requirement for maintenance: Values can be changed, but depend on **LWT** values ! If you need to remove a value or add value, proceed the same way as for **LWT**, and update formula in "D4".

Stage of lactation: Values can be changed. If you need to remove a value or add value, proceed the same way as for **LWT**. Don't forget to adapt the corresponding **Protein req** values and the formula in "D13".
Values in AC column need to be changed accordingly, and **Ca req** and **P req** values need to be updated.
Source values need to be changed in the VBA program in the initialization function.

Protein req: Values can be changed, but depend on **stage of lactation** values. If you need to remove a value or add value, proceed the same way as for **LWT**. Formula in "D13" has to be updated.

Pregnancy: Values can be changed. Don't forget to adapt the corresponding **ME req** values and update formula in "D5". If you need to remove a value or add value, proceed the same way as for **LWT**.
Source values need to be changed in the VBA program in the initialization function.

ME req: Values can be changed but depend on **pregnancy** values. If you need to remove a value or add value, proceed the same way as for **LWT**. Formula in "D5" has to be updated.

Protein: Values can be changed. If you need to remove a value or add value, proceed the same way as for **LWT**. If you change a protein value, it has to be changed as well in the **Fat/Protein matrix**.
Source values need to be changed in the VBA program in the initialization function.

Fat/Protein matrix: Values can be changed but require attention. All corresponding energy requirements need to be updated and formula "Index" in cell "D6" needs to be changed accordingly.
Source values need to be changed in the VBA program in the initialization function.

CS & LW Ch/lactating or dry: Values can be changed but require a formula change in cell "D9" and corresponding **Energy** values have to be changed consequently.

Energy: Values depend on **CS & LW Ch/lactating or dry values** (Weight gain or loss and lactating stage). It can be changed according to **CS & LW Ch/lactating or dry value** changes and formula in cell "D9" has to be updated.

Milk range: Values can be changed but require formula update in "D25" and corresponding changes in **Corresponding Percent concentrate dry matter of the total dry matter intake** column**.**

Corresponding Percent concentrate dry matter of the total dry matter intake: Values can be changed. To add or remove a value, proceed the same way as for **LWT**, changed the **Milk range** values accordingly and update formula in cell "D25".

Ca req: values can be changed. To add or remove a value refer to **Stage of lactation** change.

P req: values can be changed. To add or remove a value refer to **Stage of lactation** change.

Sheet 3: Ration form

Most data are automatically displayed thanks to formulas and shall not be changed.
Calculation of maximum DM intake (cell "H18") depending on cow live weight can be changed, with modification of formula in cell "F18".

Attention!
Concentrate and NDF intakes have to be carefully checked. Concentrate and NDF requirements depends on DM intake (they are expressed in percentage of dry matter) and cannot be taken into account by the algorithm when user clicks on the "Calculate ration" button, because the problem to solve would not be linear anymore. As a result, user has to pay attention to these and adjust fresh feed intake if necessary.

Sheet 4: MIFC

Most data are automatically displayed thanks to formulas and shall not be changed.

Sheet 5: Feed database

FAO FEED DATABASE

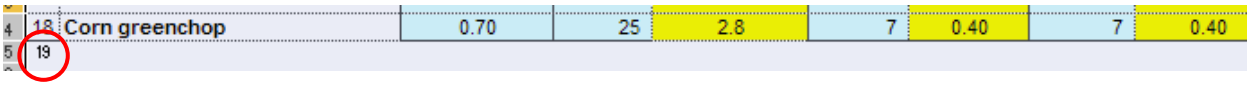
			A	B	C	D	E	F	G	H	I	H	I	H	I		
		Insert numbers only in the blue cells	Price	DM content	DM price	ME content	ME price	CP content	CP price	NDF content	NDF price	Ca content	Ca price	P content	P price	Concentrate content	Forage content
		Feed	your currency/kg	%	your currency/kg DM	MJ/kg DM	your currency/MJ of ME	%	your currency/kg CP	%	your currency/kg NDF	% DM	your currency/kg Ca	% DM	your currency/kg P	%DM	%DM
	No.	Formula			A / B x 100		C / D		C / F		C / H		C / H		C / H		
7	1	<Empty>	0.00	-	0.0	-	0.00	-	0.00	-	0.0	-	0.0	-	0.0	-	-
8	2	Fresh grass	1.00	20	5.0	8	0.63	12	0.42	60	0.1		0.0		0.0	-	100
9	3	Rice hay	1.20	85	1.4	6	0.24	6	0.24	80	0.0		0.0		0.0	-	100
10	4	Sweet corn trash	0.20	15	1.3	11	0.12	8	0.17	40	0.0		0.0		0.0	-	100
11	5	Bean silage	0.20	20	1.0	9	0.11	25	0.04	30	0.0		0.0		0.0	-	100
12	6	Formulated concentrate	8.00	90	8.9	12	0.74	18	0.49	20	0.4		0.0		0.0	100	
13	7	Rice bran A	6.00	90	6.7	11	0.61	14	0.48	27	0.2	0.09	74.1	1.79	3.7	100	
14	8	Rice bran B	4.00	90	4.4	8	0.56	8	0.56	35	0.1		0.0		0.0	100	
15	9	xxx	0.10	1	10.0	1	10.00	1	10.00	1	10.0		0.0		0.0	-	100
16	10	Reject potatoes	0.5	15	3.3	13	0.26	6	0.56	20	0.2		0.0		0.0	100	-
17	11	Corn stover	0.50	23	2.2	9	0.24	6	0.36	50	0.0		0.0		0.0	-	100
18	12	Soybean cake	20.00	90	22.2	14	1.59	45	0.49	20	1.1	0.39	57.0	0.69	32.2	100	-
19	13	Maize grain	10.00	90	11.1	13	0.85	11	1.01	10	1.1	0.05	222.2	0.30	37.0	100	-
20	14	Brewers grain	4.00	80	5.0	10	0.50	25	0.20	40	0.1	0.27	18.5	0.57	8.8	100	-
21	15	Sago chips	8.00	88	9.1	13	0.70	2	4.55	10	0.9		0.0		0.0	-	100
22	16	Rice straw	1.2	90	1.3	5	0.27	5	0.27	80	0.0		0.0		0.0	-	100
23	17	Molasses	5.00	80	6.3	14	0.45	3	2.08	1	6.3		0.0		0.0	100	
24	18	Corn greenchop	0.70	25	2.8	7	0.40	7	0.40	65	0.0		0.0		0.0	100	

Up to 100 ingredients can be listed. Be careful: nutritional values of ingredients are entered on a dry matter (DM) basis. In the program, ration analysis results are mostly displayed as fed, the conversion is automatically done.

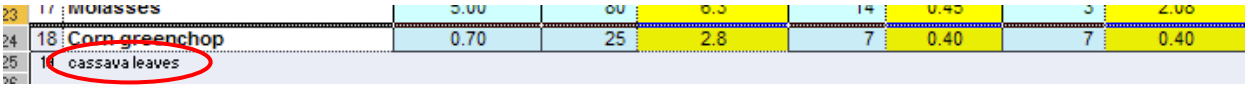
Do not forget that yellow cells contain formulas and that any change can affect the program.
Check on the following page to add an ingredient.

To add an ingredient:

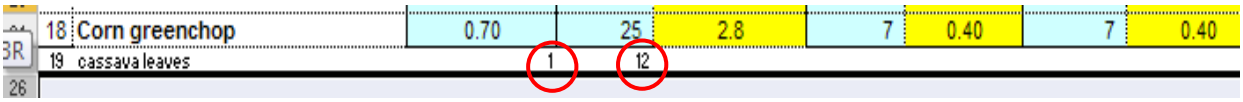
- Click on the next empty cell in column A: enter the next ingredient number



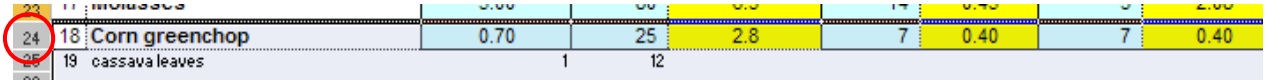
- Click on the right cell in column B and enter the name of the ingredient you want to add



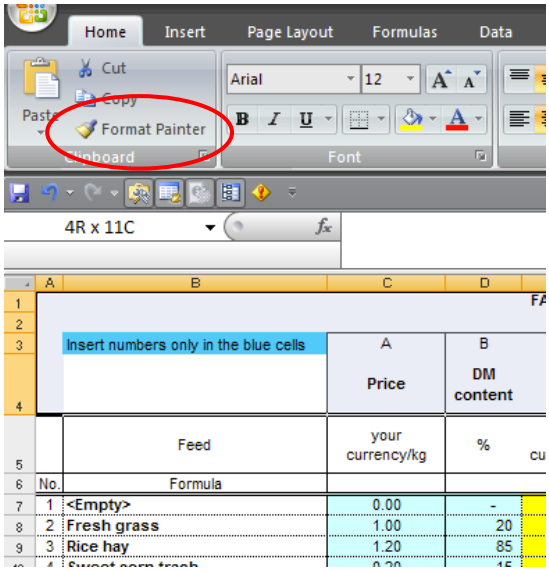
- Enter its price and DM content respectively in columns C and D



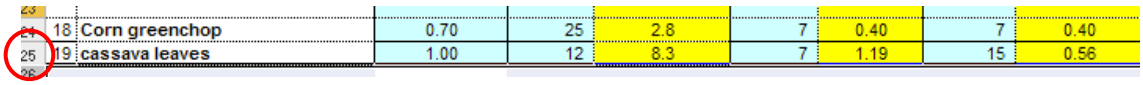
- The next cell is a yellow cell. A formula has to be copied. To do so, click in the cell column E but on the previous row (ingredient 18 in the example with value 2.8). Place the mouse cursor on the bottom right of the cell. The cursor shape, normally a white cross should change to a black cross. Click then and hold the click, then go down to the cell in column E on the following row (row with ingredient 19 in the example). Unhold the click, the formula has been copied with the correct values.
- Repeat the same operations for yellow cells and fill blue cells with the appropriate ingredient value.
- When you've completed the entire row, click on the left row number of the previous row, to select all the previous row (24 in this example)



- Go and click on the format painter



- Click on the left row number of the row you've just completed (25 in this example), the format is now the same than previous rows.



Ingredients are classified into 2 categories, forage or concentrate. When an ingredient is a forage, enter 100 in the forage column, and 0 in the concentrate column. If an ingredient is a concentrate, enter 100 in the concentrate column and 0 in the forage column (when you enter 0, the excel sheet might show -). If an ingredient is a mix of both, adjust the values accordingly (enter for example 30 for forage and 70 for concentrate if the ingredient used contains actually 30% of forage and 70% of concentrate), and if it is none of it (for example Ca or P salts), put 0 in both columns. No changes need to be made in initialization function in the VBA program.

[Note: As an administrator when you are entering feed ingredients, their chemical composition, price etc. in the Excel sheet: Feed database, please do not touch the <Empty> row. Do not replace <Empty> with another feed ingredient. This row (<Empty>) is vital for deselecting a feed ingredient. Also, do not delete "<" or ">" sign which is before and after Empty respectively]

Sheet 6: Energy for milk prod

This is the reference for the Fat/Protein matrix. It is not used by the program but kept as a reference. If changes are made in the matrix in sheet 2, changes should be made as well here and in return.

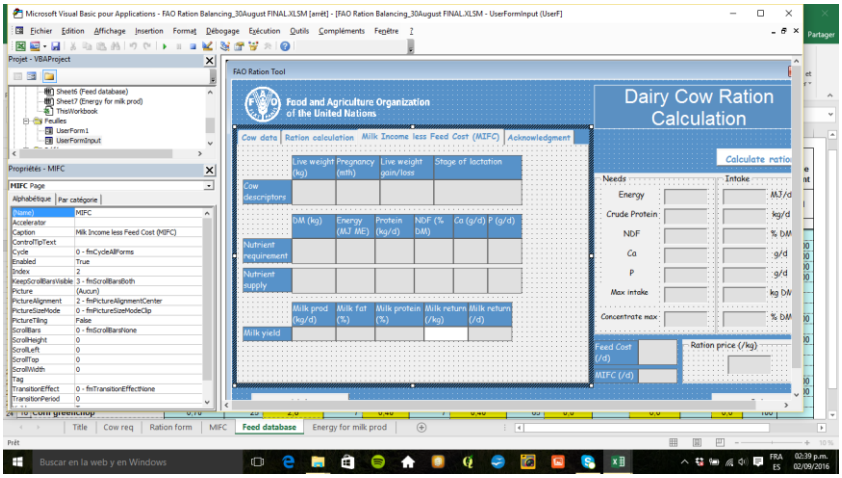
2. Access the VBA program

Attention!
Some codes are specific to recent VBA version and do not work with Excel 2007.

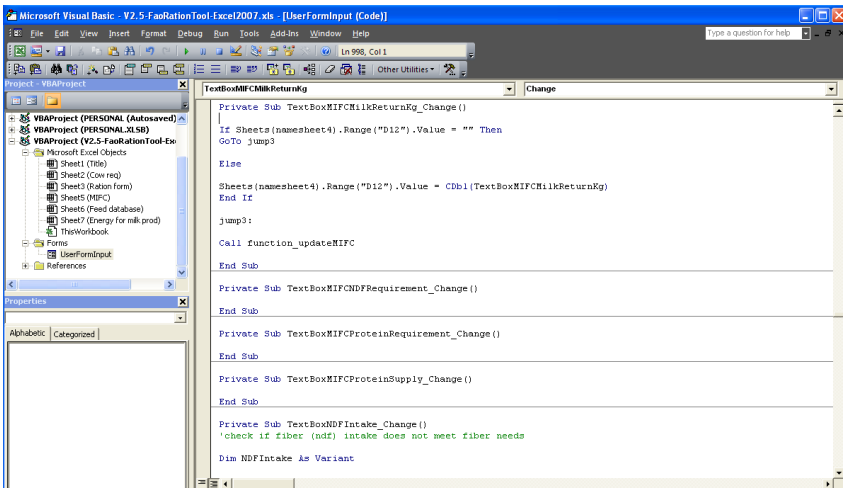
Administrator has to install the Analysis ToolPak – VBA to have access to the program:

1. Click on « File » tab
2. Click on « Options »
3. Select « Add-ins »
4. Click « Go…» button
5. Select « Analysis ToolPak VBA»
6. Validate.

Go to the « Developer » tab and click on the « Visual Basic » button. In the "Project – VBA project" window, double click on the "UserFormInput". You should get the following window on your screen



Note: to add the "Developer" tab, go to "File", "Options", then "Customize Ribbon" and select the tab.
Double click on any element of the user form to have access to the VBA code, as follow:



3. Functions and code description

Code / function	Description	Related functions
Private Sub ComboBoxFeed$$_Change()	When the ingredient n°$$ is changed in user form, the change is made in Excel file, its price is updated in user form, and values are updated in user form.	function_valueUpdate function_FeedExist
Private Sub CommandButtonAdmin_Click()	When user click on "Admin" button, password is asked to access the Excel file. Password is set as "FAO2016" by default and can be changed here. If user click on cancel he's back to the user form. If password is wrong user is asked again to enter the correct password.	
Private Sub TextBox$$Intake_Change()	If nutrient intake values are greater or lower than its constraints, intake values appear in red (conditional formatting).	
Private Sub TextBoxFeed10Intake_Change()	When user change the quantity of an ingredient in the ration, or when solver find a solution and ingredient quantity is changed, quantity of the ingredient is saved in the Excel file.	function_valueUpdate function_updateMIFC
Private Sub CommandButtonOptimization_Click()	Set solver constraints, target cell, variable values, and options for least cost ration calculation.	function_intakeUpdate function_valueUpdate function_updateMIFC
Private Sub CommandButtonQuit_Click()	When user click on the "Quit" button a window is displayed asking him if he really wants to quit or cancel. If he clicks on Quit the user form closes, if he clicks on Cancel he's back to the user form.	
Private Sub ComboBoxFat_Change()	Automatically display the energy requirement corresponding to the volume, fat and protein input data on the User Form and update values on Excel sheet when milk fat content is changed by user on the user form	*function_calculateEnergy Needs*
Private Sub ComboBoxLWT_Change()	Automatically display the energy requirement corresponding to the LWT input data on the User Form and update values on Excel sheet	function_updateMIFC
Private Sub ComboBoxPregnancy_Change()	Automatically display the energy requirement corresponding to the Pregnancy input data on the User Form and update values on Excel sheet	function_updateMIFC
Private Sub ComboBoxProtein_Change()	Automatically display the energy requirement corresponding to the volume, fat and protein input data on the User Form and update values on Excel sheet	*function_calculateEnergy Needs*
Private Sub ComboBoxStageOfLactation_Change()	Automatically display the protein requirement corresponding to the stage of lactation input data on the User Form and update values on Excel sheet	
Private Sub TextBoxLWTGain_Change()	Automatically display the energy requirement corresponding to the LWT Gain or loss input data on the User Form and update values on Excel sheet when LWT Gain/loss is changed by user on the user form	function_updateMIFC
Private Sub TextBoxMaxFeed$$_Change()	When user set the maximum quantity of the ingredient n°$$ available per day for a cow, the value is saved in the Excel file	
Private Sub TextBoxMIFCMilkReturnKg_Change()	When user changes the milk return value in the user form, the value is changed on the Excel file.	function_updateMIFC
Private Sub TextBoxPrice1_Change()	When user changes the price of an ingredient in the user form, the price is updated in the Excel file. Values are updated.	function_valueUpdate function_updateMIFC
Private Sub TextBoxVolume_Change()	Automatically display the energy requirement corresponding to the volume, fat and protein input data on the User Form and update values on Excel sheet when milk production volume is changed by user on the user form	function_updateMIFC *function_calculateEnergy Needs*
Private Sub UserForm_Initialize()	Variables for Excel sheets are set. If names of sheets are changed in Excel file, it has to be changed here as well (for translation for example). When user opens the Excel file, this is the function that makes all values displayed on the user form.	function_valueUpdate function_updateMIFC
Public Function function_valueUpdate()	Total ration price is updated. Nutrient values (intake) are updated.	
Public Function function_intakeUpdate()	Display feed intake value given by solver after an automatic ration calculation and format value with 2 decimal	
Public Function function_FeedExist()	When user selects an ingredient, checks the ingredient has already been selected or not. If the ingredient has already been selected, a warning message is displayed.	
Public Function function_updateMIFC()	Calculate MIFC values and display it on user form.	
Public Function function_calculateEnergyNeeds()	Calculate energy needs corresponding to milk volume, milk fat and milk protein cow data. Take into account number format issues that can occur with Excel.	

Contact at FAO:

Harinder P.S. Makkar
Animal Production and Health Division
Food and Agriculture Organization of the United Nations (FAO)
Rome, Italy

E-mail: Harinder.Makkar@fao.org