Before optimizing the feed ration for your herd with NorFor Feed Ration Optimizer, some steps need to be taken to make sure the optimization is done accurately. This means that the feed components of your ration should have the correct analysis, prices and limits.

This guide will walk you through the steps to assure an optimal use of the NorFor Feed Ration Optimizer, nutritional and economically.
OPTIMIZING STEP BY STEP

Optimizing the ration can be resumed in 4 steps that should be carried out to get the desired printed results. In this guide you will also find another use of the NorFor Feed Ration Optimizer.

1. Create Herd Feedstuffs table: Select Feedstuffs, analysis and adjust prices
3. Interpretation of results: Color coding and re-optimization
4. Print the result
5. Other features: Compare different feed ration alternatives with Ration Optimizer- Comparing feed ration alternatives in the same sheet

1. Create the Herd Feedstuffs table

The software contains three tables with feedstuff.
-“NorFor feedstuffs” shows all the available feedstuffs that are included in the Norfor Feed Stuff Table (FST).
-“Feed analyses” contains the nutritive values of the feedstuff from the user’s farm. The results of the analyses are reported by the laboratory in this table.
-“Herd Feedstuff” is empty at the beginning. This table will contain the feedstuffs to use for the optimization. In order to fill this table, the desired feedstuff to use should be transfer from the two tables above described. In order to fill this table follow these steps.

1.1 Open “Herd Feedstuffs” tab by clicking the green menu on the left. Click “Transfer from Norfor feedstuffs”. The table “Norfor feedstuffs” will pop-up.
1.2 Mark the desired feedstuff on the list (e.g. rapeseed meal) and click “Transfer to Herd feedstuffs”.

1.3 If a mix of feedstuff needs to be added to the Herd Feedstuff (e.g. the user has a wheat and barley mix) select “New” button in the “Feed mixture” box. The window “Create Feed mixture” will pop-up.

1.4 In the “Create Feed mixture” window select the feedstuff and click “Add feedstuff”, fill in their amounts and the total amount of the mixture. Then press “Save close” (the new mixture will automatically be send in the “Herd feedstuff”).
1.5 Select the Feed mixture just created and repeat step 1.2
1.6 All the feedstuffs needed for the optimizations should be done as point 1.2. Feedstuff can be transferred from the table of “Norfor feedstuffs” or “Feed analyses” to Herd feedstuffs.

**Prices of the feedstuff**

After the selected feedstuff are added to the *Herd feedstuffs* table, prices should be set to each of them. Two types of prices that can be used, one price for optimizing the ration (“Optimization price per kg”) and another price for calculating actual feed costs (“Actual price per kg”). This price division criteria can be useful, for example, when the maximum amount of roughage harvested in the farm wants to use. This can be done by using a lower “optimizing price” for it and maintaining the real “actual price” in order to assure maximum use of the roughage.

Although most of the time the same price value will be used for both “Actual price” and “Optimization price”. The price of a feedstuff can be changed through the steps below.

1.7 Double Click the feedstuff from the “Herd Feedstuff” tab or directly from the “Ration optimizer” tab. The window “Edit Feedstuff” will pop up.

1.8 Press “Edit” on the “Selected settings”. The window “Setting” will pop-up.

1.9 On the “Settings” window select the “Price” parameter and move it to the right box with the arrow. Press “Save” and “OK” to close the window.

1.10 Once on the “Edit feedstuff” window click on both prices in order to change them. After press “Save” and close the window.

2 Adjusting Ration optimizer and optimization

After completing the “Herd Feedstuff” and adjusting the prices, the next step is to select the ration parameters and set up limits on the “Ration Optimizer”. Feedings plans for dairy cows, dry cows, bulls, heifers and beef cattle can be produced in the “Ration Optimizer” tab. In order to create a new feeding plan and set it up for optimization follow the steps below.
2.1 Once in the “Ration optimizer” tab in the green menu press “New” to start. The window “Create feed ration” will pop up.

2.2 Name the new feed ration, select the animal type and press “OK” to close the window.

2.3 In the “Animal and basic information” tab, choose the herd characteristics: feeding strategy (TMR, flat rate feeding or define yield groups), breed, housing and fill in the average yield of the herd. In this example a TMR for producing dairy cows will be created, so the ticks for dry cows and calving heifers can be taken away.
2.4 Select the “Feeding” tab. This is where the ration optimization will be performed.

2.5 Add feedstuff from your “Herd feedstuff” table created before. Click “Add/remove” button under de Feedstuff box. The window “Select feedstuff” will pop-up.
2.6 Select the desired feedstuff for optimization and move it to the box on the right hand side with the arrow or by double clicking. When all the needed feedstuff are selected click “OK” to close.

![Image of feedstuff selection](image1.jpg)

NOTE: Remember all feedstuff need to have prices for a correct optimization.

After selecting feedstuff the “Ration parameters” should be selected.

2.7 The software has a default setting of ration parameters. To change these parameters click the button “Add/remove ration parameters”. The “Set up ration parameters” window will pop-up.

![Image of ration parameters](image2.jpg)
2.8 On the “Set up ration parameters” window select the desire parameters and move them to the right side with the arrow. Finally press “OK”.

Good parameters to add:
- Fill value balance
- Crude protein
- CAB-value (for dry cow feeding)

And sometimes:
- Magnesium, g/kg DM
- Starch and sugar, g/kg DM
- Vitamins
- Other minerals

The added parameters will depend on what is needed to be check on the feed ration.

2.9 “Optimizing parameters” are parameters the software will use for optimizing the ration. Many parameters can be viewed at the time of creating rations, but optimization should be based on a few. The more parameters are selected (tick) for optimization the harder is to get a solution with correct results. By default there are 6 parameters for optimization marked in the “Opt” column (Optimizing column). To add or remove optimizing parameters click or unclick the selected parameter under the “Opt” column.
2.10 Tick the box “Min/max Limits” to see the limits of the parameters and feedstuff.

2.11 Minimums and maximum can be defined for feedstuff or parameters by clicking in the box and filling the limit value. E.g. Minimum 4 kg DM of Grass silage for Dairy cows.

NOTE: Always start optimizing with few limits and if necessary add limits one at a time, while checking the results. The amounts of limits depend on several characteristics like amount of feedstuff, their quality, the type of animal (e.g. dry cows, lactating cows, etc.) and production level.
2.12 Press the “Optimize” button in the “Result” box to start optimization of the feed ration by the software. Although there are several possibilities for animal feed rations, the software will give the cheapest solution within the limits decided before.

2.13 Results can be shown in Kg feed or Kg dry matter. To change the unit click on the option under the “View” box.

3 Interpretation of results.

To interpret the results NorFor Feed Ration Optimizer created a Color coding. The color of the title “*In ration” will define if the feed ration is balanced based on the steps done above.

3.1 If the ration is balanced it will be green
3.2 If the feed ration is unbalanced it will be red.
3.1 **BALANCED: Green in ration** The optimization has succeeded and all the limits of the optimizing parameters (with ticks) are met.

Under the balance feed ration (in green) Ration parameters can appear colored too, as seen below.

**Yellow value:** The result of this parameter ended up on the minimum or maximum limit stablished before the optimization.

**Red values:** The result is below the minimum limit or above the maximum limit. In a balanced ration, some ration parameters can become red, because they are not selected for optimization (no tick in the “Opt” column) E.g. Calcium is lower than the minimum limit but was not selected for optimization. To meet the calcium requirements feedstuff rich in Ca, such as limestone, might have to be added. (Important! Make sure that feedstuff that can meet the new limits in the optimization are added.)
3.2 **UNBALANCED Red *In ration**: The optimization has not succeeded based on the chosen ration parameters criteria. This can be due to too many parameters selected for optimization or the limits selected for feedstuff or ration parameters are too narrow. Changes should be made for re-optimization.

In an unbalanced ration, some “Optimization parameters” will be in red figures. Not always, optimization limits should be change on these ration parameters. It is more likely the limits for the yellow figures should be adjusted (if there are any yellow figures) or changing the parameters for optimization.

**Optimizing example**: The user wants to feed at least 4 kg DM of maize silage and also have up to 2.5kg DM of Faba beans that wants to be used in the ration.

i. Introduce a minimum limit of 4 kg DM on the maize silage row (at least 4 kg DM should be used).

ii. Introduce a maximum limit of 2.5 kg DM on the faba beans row (up to 2.5 kg DM can be used).
iii. Starch should be limited in order not to have too high amount of starch in the ration. Introduce Maximum limit on starch 210 g /kg DM and tick the box on the Opt column.

iv. Click on the optimize button and get the results.
*In ration* is green so the ration is balanced according to all the parameters marked with a tick.

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Unit</th>
<th>Cent/kg</th>
<th>Min.</th>
<th>In ration</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring barley</td>
<td>Kg DM</td>
<td>13.5</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapeseed meal, extracted</td>
<td>Kg DM</td>
<td>29.0</td>
<td>3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soya bean, extracted</td>
<td>Kg DM</td>
<td>45.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faba beans</td>
<td>Kg DM</td>
<td>20.0</td>
<td>2.5</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Maize silage, medium OM</td>
<td>Kg DM</td>
<td>4.5</td>
<td>4.0</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Clover grass silage, 1st cu</td>
<td>Kg DM</td>
<td>4.7</td>
<td>9.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fodder salt</td>
<td>Gr DM</td>
<td>10.0</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>AlkoFeed Gigant 80, Veg f</td>
<td>Kg DM</td>
<td>90.0</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Konro Klever/Maps Natur 1</td>
<td>Gr DM</td>
<td>70.0</td>
<td>210</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ration parameter</th>
<th>Unit</th>
<th>Opt.</th>
<th>Min.</th>
<th>In ration</th>
<th>Max.</th>
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</thead>
<tbody>
<tr>
<td>Protein balance in rumen</td>
<td>g/kg DM</td>
<td>157.4</td>
<td></td>
<td></td>
<td>66.6</td>
</tr>
<tr>
<td>Energy balance</td>
<td></td>
<td>100.0</td>
<td>100.0</td>
<td></td>
<td>100.0</td>
</tr>
<tr>
<td>AAT to energy ratio</td>
<td>gMU</td>
<td>15.0</td>
<td>15.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AAT intake to NEL intake</td>
<td>gMU</td>
<td>14.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein balance in rumen</td>
<td>g/kg DM</td>
<td>0.50</td>
<td></td>
<td></td>
<td>0.60</td>
</tr>
<tr>
<td>Energy balance</td>
<td></td>
<td>100.0</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AAT intake to NEL intake</td>
<td>gMU</td>
<td>14.2</td>
<td></td>
<td></td>
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<tr>
<td>Protein balance in rumen</td>
<td>g/kg DM</td>
<td>0.50</td>
<td></td>
<td></td>
<td>0.60</td>
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<tr>
<td>Energy balance</td>
<td></td>
<td>100.0</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: In this case the Faba beans tops on Max level because of the favorable good price and Rapeseed meal fills up the rest of the protein requirement. There is no Soybean meal in this feed ration, because in this case it is too expensive and would make the ration more expensive.

4. **Printing the results**

When optimization is ready, the results can be printed on paper or saved as a document in the computer. Feedstuff, feed rations and TMR recipes can be printed.

4.1 To print the result of the optimized feed ration press the “Print” button under the printout box.
4.2 To preview or save the printouts, press “Preview” in the “Printout” box. The printout can be saved as a pdf or excel document for distribution or further calculations.

4.3 If the results of the optimized feed ration will be fed as TMR and a recipe wants to be printed follow the steps below

4.3.1 Create a Feed mixture by pressing “New” in the “Feed mixture box”. The window “Create fed mixture” will pop up.
4.3.2 Tick on the feedstuffs that should be included in the TMR and press “OK” button when finished.

4.3.3 The Feed mixture row will replace all the ingredients of the TMR in the Feedstuff column.

4.3.4 To see all the feedstuff individually click the “+” button to open the Feed mixture components.
4.3.5  Feedstuff can be changed in order of appearance (e.g. order of filling the mixer wagon). Press “Edit” button under the “Feedstuff” box. The window “Feed mixture recipe” will pop up. To move the feedstuff press the up or down arrows and save when finished.

4.3.6  Press “Preview” on the “Printouts” box and choose “Mixing recipe“. Set the number of animals for this ration and press “OK” to see the printout. Then you can either print it or save it in the computer.

5.  Other features: Compare different feed rations alternatives with “Ration Optimizer”

It is possible to include several rations in the same sheet with NorFor Ration Optimizer. This will allow the comparison of the rations parameters. It can be useful for example to analyze which protein feed is more profitable within the rations.

To compare rations follow the steps below.
5.1 On the “Ration optimizer” tab click “New” to create a new feeding plan, the “Create feed ration” window will pop-up.

5.2 Name the new feed ration, select the animal type and press OK to finish.

5.3 On the “Animal and Basic information” tab select the principle “Define yield groups”. Groups for comparison will appear. This groups can be used with the default values or be changed in order to fit the herd by clicking on the parameters.
5.4 After changing parameters press “Save” under the “Ration optimizer” button and pass to the “Feeding” tab to add feedstuff and compare Groups and rations.

Example:

There is a need to decide between rapeseed expeller (Group 1), rapeseed meal (Group 2) or soybean meal (Group 3). The farmer decided that 5 kg DM of maize and maximum 2.6 kg DM of Faba beans can be used.

i. Each group will have a 0 max in the other feedstuff that are not included in the group. Maize and faba beans limits are also included. After all limits are set up, press Optimize button.

ii. Prices and parameters of the three groups (rations) are shown.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring barley</td>
<td>Kg DM</td>
<td>13.5</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
</tr>
<tr>
<td>Rapeseed meal, extracted</td>
<td>Kg DM</td>
<td>27.0</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Deleterio rapeseed expeller</td>
<td>Kg DM</td>
<td>29.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>Kg DM</td>
<td>45.0</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Faba beans</td>
<td>Kg DM</td>
<td>20.0</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Maize silage, medium OM</td>
<td>Kg DM</td>
<td>4.5</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Clover grass silage, 1st cut</td>
<td>Kg DM</td>
<td>4.7</td>
<td>8.8</td>
<td>8.8</td>
<td>8.8</td>
<td>8.8</td>
<td>8.8</td>
<td>8.8</td>
</tr>
<tr>
<td>Fodder salt</td>
<td>Gm DM</td>
<td>10.0</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Akofeed Gigant 80, Veg 1</td>
<td>Gm DM</td>
<td>90.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Komix Klever/Majz Netur 1</td>
<td>Gm DM</td>
<td>70.0</td>
<td>249</td>
<td>210</td>
<td>210</td>
<td>210</td>
<td>210</td>
<td>210</td>
</tr>
</tbody>
</table>

This tool allows the comparison between alternatives on the price and also on the feed parameters. It is an excellent tool for decision-taking for buying or growing feedstuff. In order for this tool to be accurate, prices should be correct and feed analysis should be representative.