Theme 3: Animal Nutrition and Feeding

GUIDELINES FOR RATION CALCULATION FOR VARIOUS BREEDS, HEIFERS, LACTATION STAGE (RUMEN8) – Level 3

Topic	Training & information Content
3.1	Estimating feeding value of fodder & feed on dairy farms
3.2	Sampling feeds & forages/analysis interpretation
3.3	Estimating Dry Matter intake for various breeds/age categories of dairy cattle in the tropics
3.4	Reviewing feed intake, rumen fill, Body Condition Scoring (BCS)
3.5	Life weight estimation of cows
3.6	Rumen fermentation
3.7	Mineral & vitamin requirement, guidelines
3.8	Manure scoring and evaluation
3.9	Guidelines for ration calculations for various breeds, heifers, lactation stage (Rumen8)
3.10	Use of Rumen8 software for ration calculation
3.11	Optimization of ration with Rumen8
3.12	Feeding management guidelines
3.13	Feeding management of dry cows/close up
3.14	Feeding systems
3.15	Metabolic disorders
3.16	Scoring locomotion and hoof condition
3.17	Mycotoxin in dairy cattle nutrition
3.18	Heat stress in dairy cattle nutrition
3.19	Monitoring feeding management, using KPIs (based on Rumen8)

1. You will learn about (learning objectives):

- ❑ Introduction to ration formulation using Rumen8 Software
- ❑ How to use Rumen 8 to determine rations of various breeds, heifers, lactation stage considering their body requirements.

IMPORTANT

This module has three parts; this is part III – ensure you download Parts I and II to cover to END.

2. Farm terrain

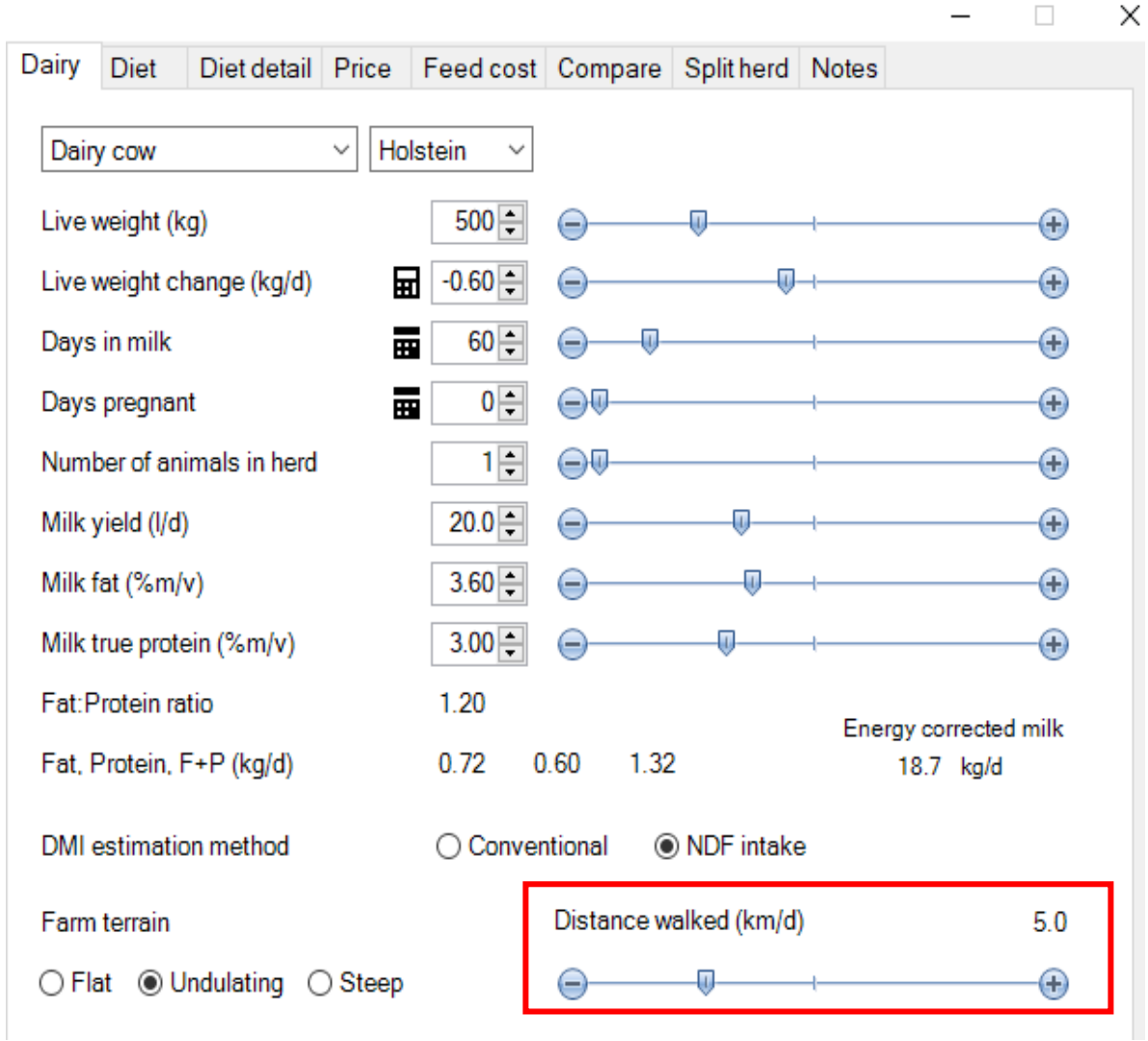
- Select one of the farm terrain that represents your farm if it is flat, undulating or steep.
- The steeper the terrain the more energy the cow uses hence this should be considered while making a ration.

Whether the farm terrain is flat, has a few hills or is hilly.

Terrain	Energy required
	4.1 MJ ME per km
	2.6 MJ ME per km
	1.6 MJ ME per km

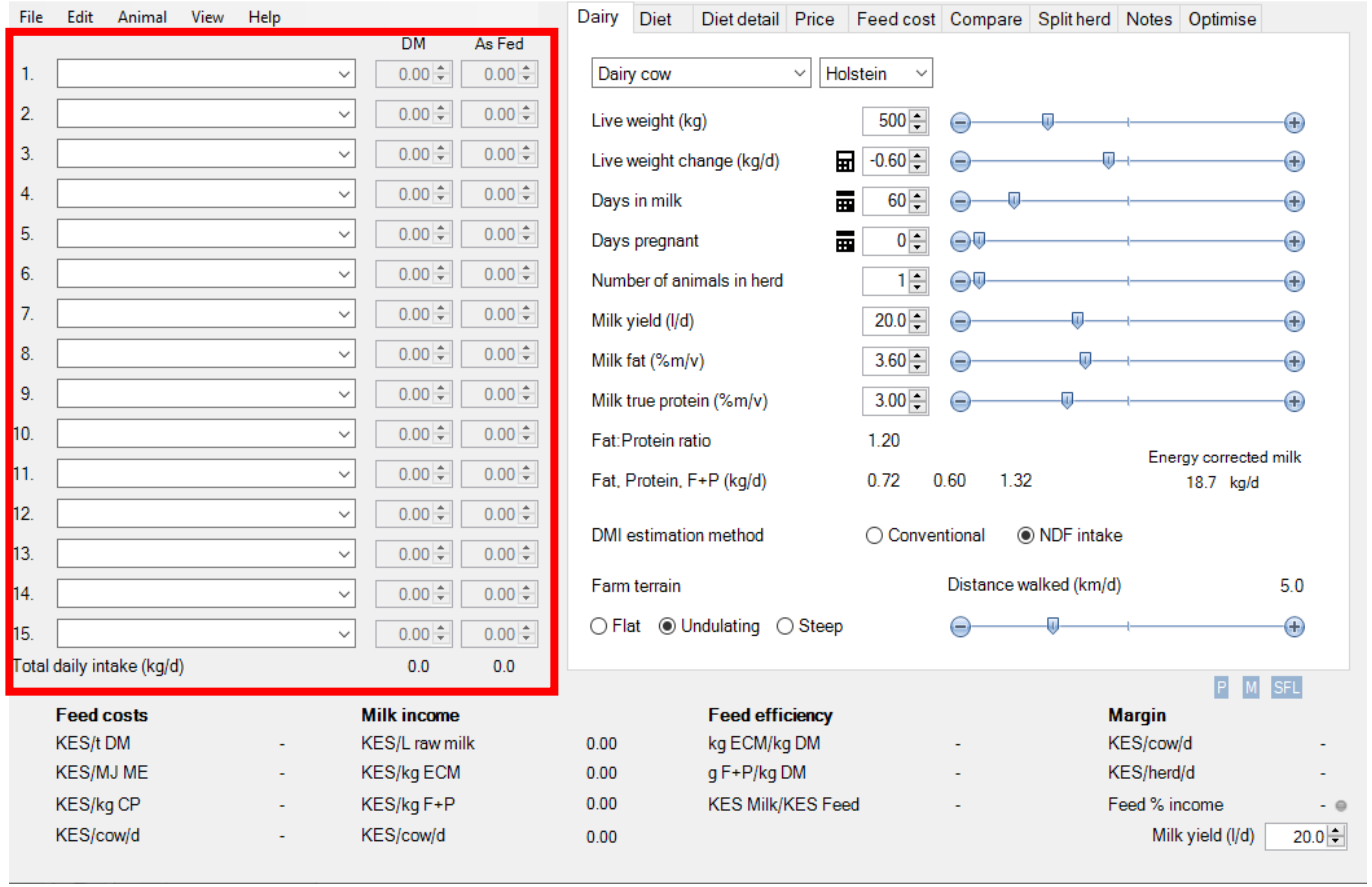
3. Distance walked (Km/d)

- The distance walked is measured in kilometers per day (Km/d).
- An accurate average distance is important because it affects the cow's daily energy requirement.
- Examples:
  - A cow grazing in large fields (300Ha) can walk 9km/day
  - Grazing a medium field (150Ha) can walk 7km/day
  - Small fields (75Ha) can walk 5km/day
  - A cow kept indoors/zero-grazing walks 0.5-1km/day.



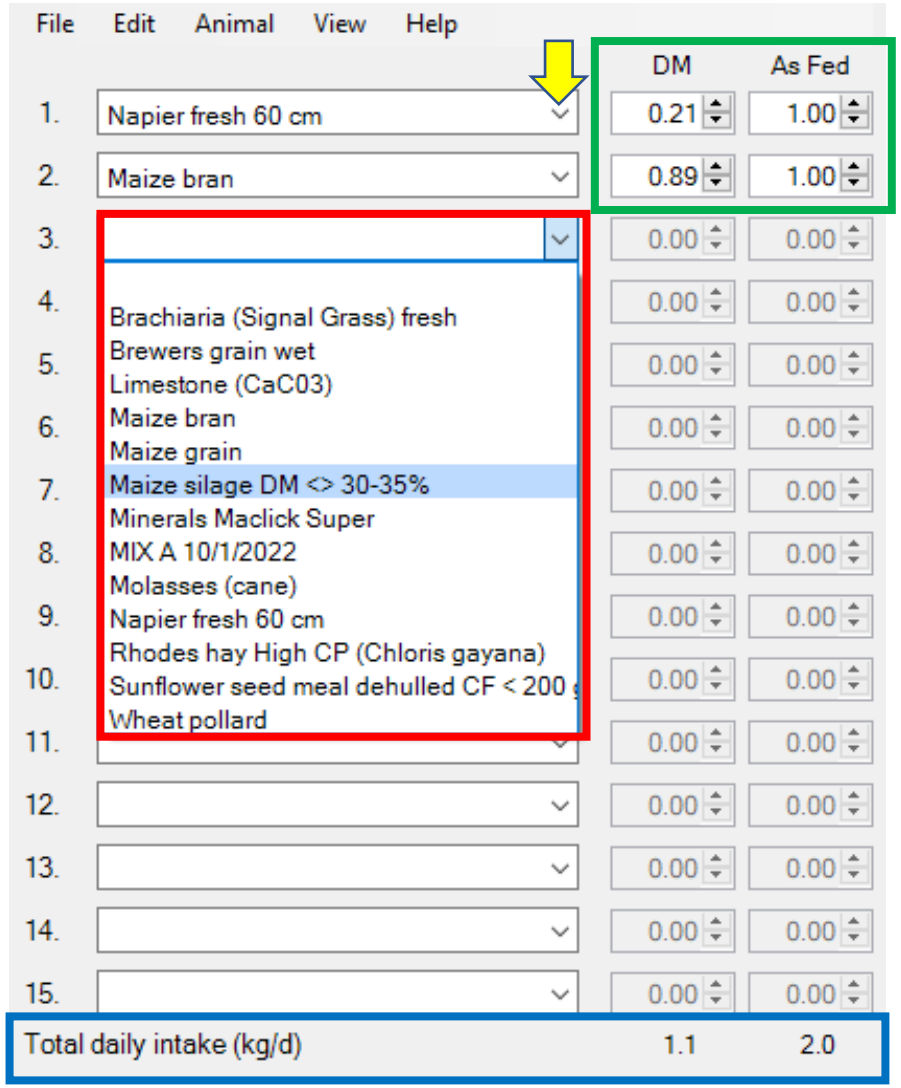
4. Ingredient entry and selection

- After filling all the required parameters for the targeted dairy cow, the next step is to make a ration using the available feeds on your farm.
- On the left-hand side of the Rumen8 landing page, the software's feed library gives you up to fifteen(15) ingredients you can select from, to make a ration (red box).



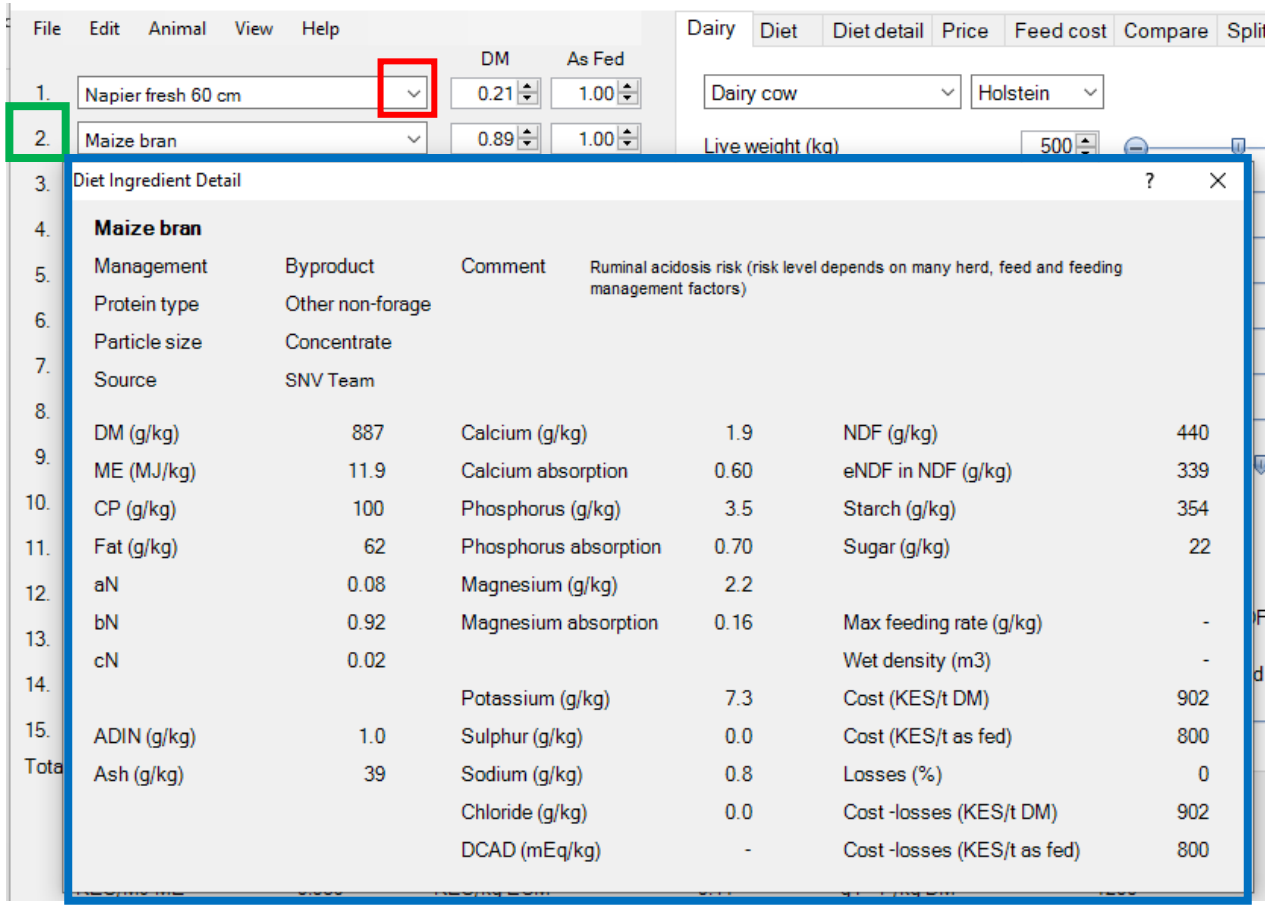
4.1 Editing the quantity of the Ingredient

- First, select an ingredient by clicking the drop-down arrow (yellow arrow), from the selected user feed library for you to choose an ingredient (red box).
- After selecting all ingredients, you can indicate the quantity of the feed-in kilogram per day (Kg/d) using either ‘As Fed’ or on a dry matter basis ‘DM’ (green box).
- In case you used the ‘As fed’ quantities, the dry matter (DM) of the feed selected will automatically be displayed and vice versa.
- The Total daily intake in DM and As fed (Kg/d) of the ration are displayed at the bottom of the ingredients section (blue box).



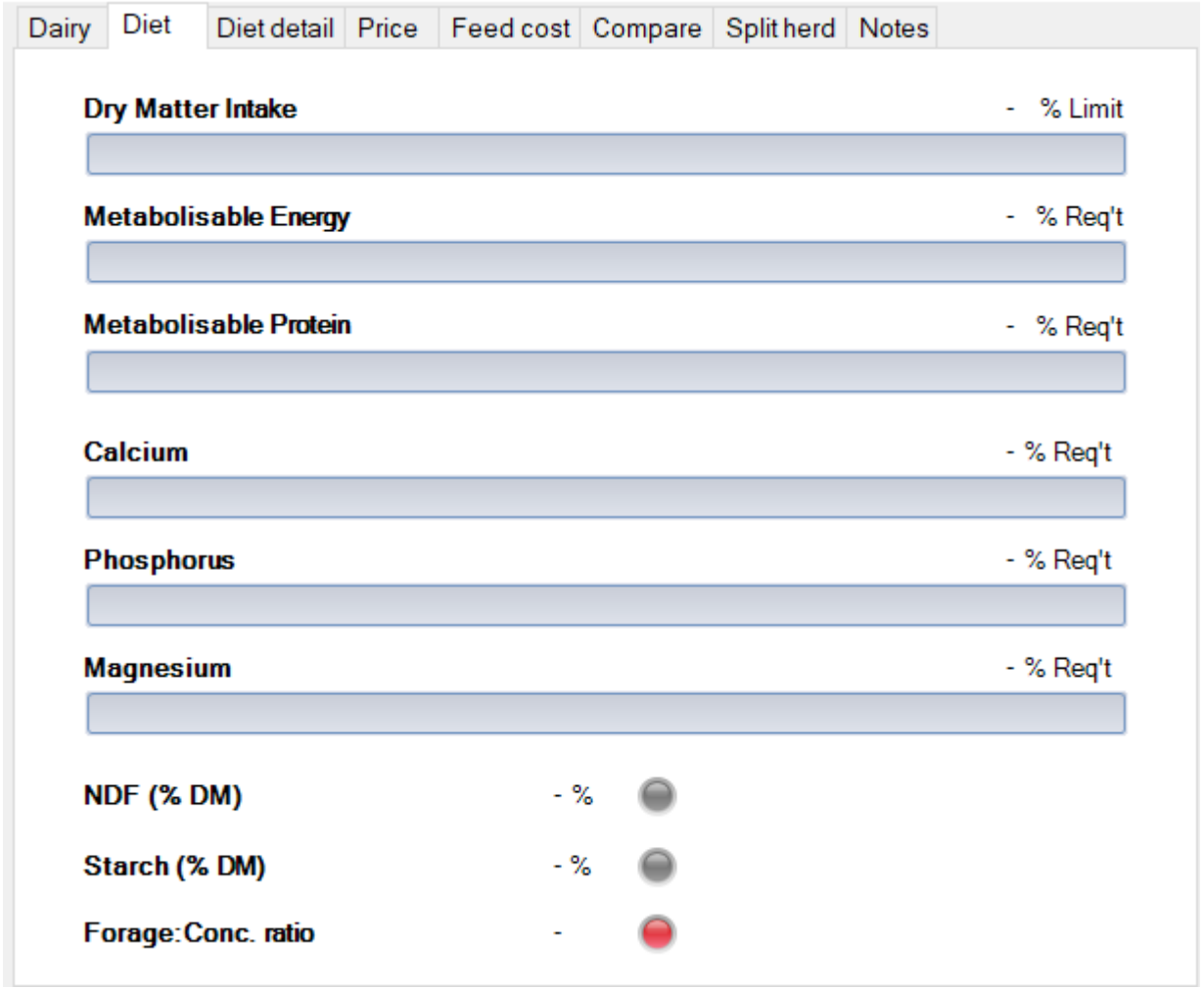
4.2 Diet ingredient details

- To view detailed information on an ingredient, hold your cursor/pointer on the drop-down arrow (red box) or for better/larger display right click on the number (green box) of the ingredient.
- A pop-up screen showing the ingredient detail will appear as shown in the image right-hand side (blue box).



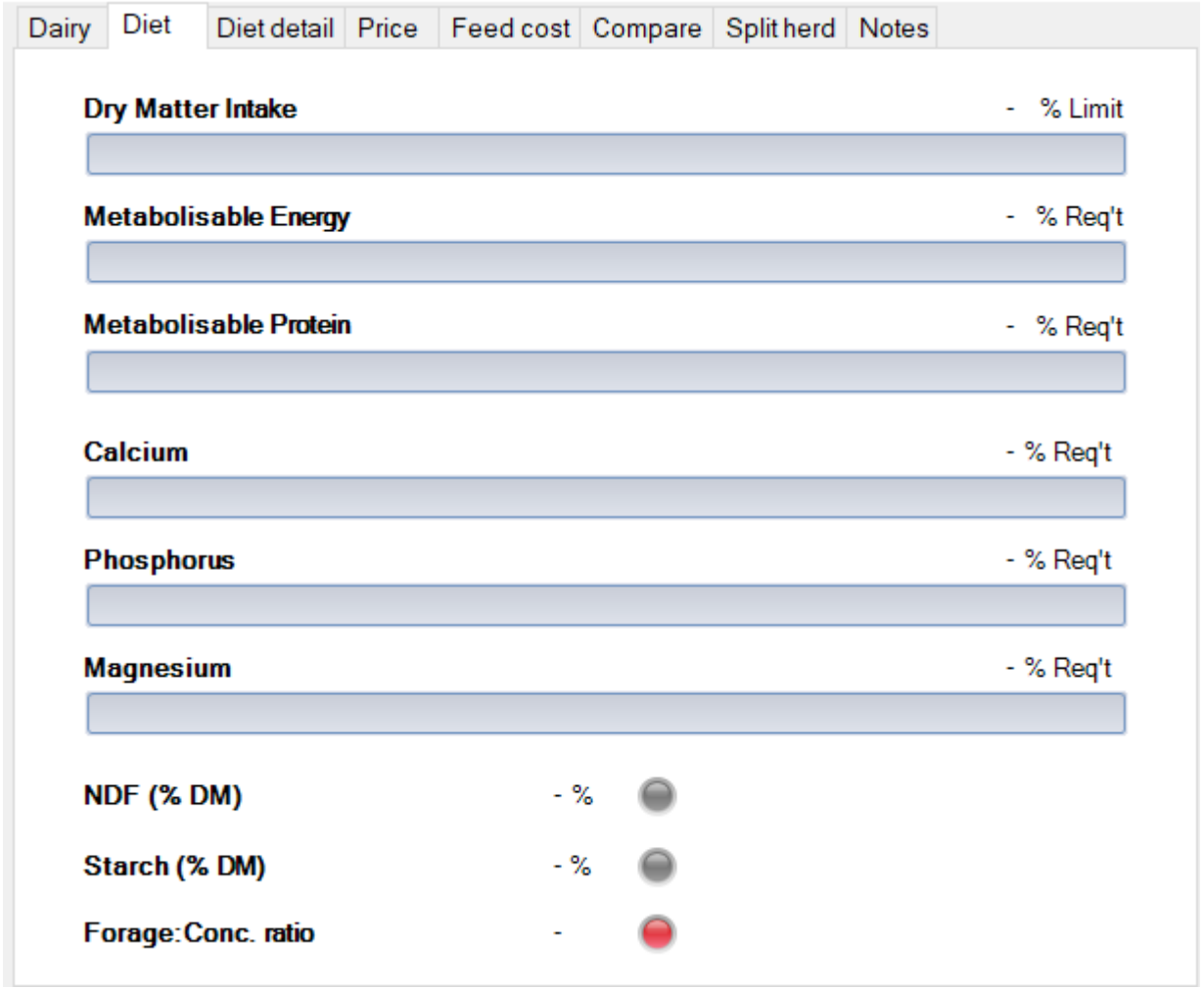
5. Diet tab

- The ‘Diet’ tab will show how the ration matches the animal’s requirement.
- Once you enter the quantity of the feeds ingredients a red bar will appear on the screen and the bar will turn green if the parameter meets the requirement of the animal and will turn yellow if the parameter exceeds the requirement of the cow.
- You can adjust the quantity of each ingredient until the quantity matches the requirement of the animal. In other words, the bars will turn green.



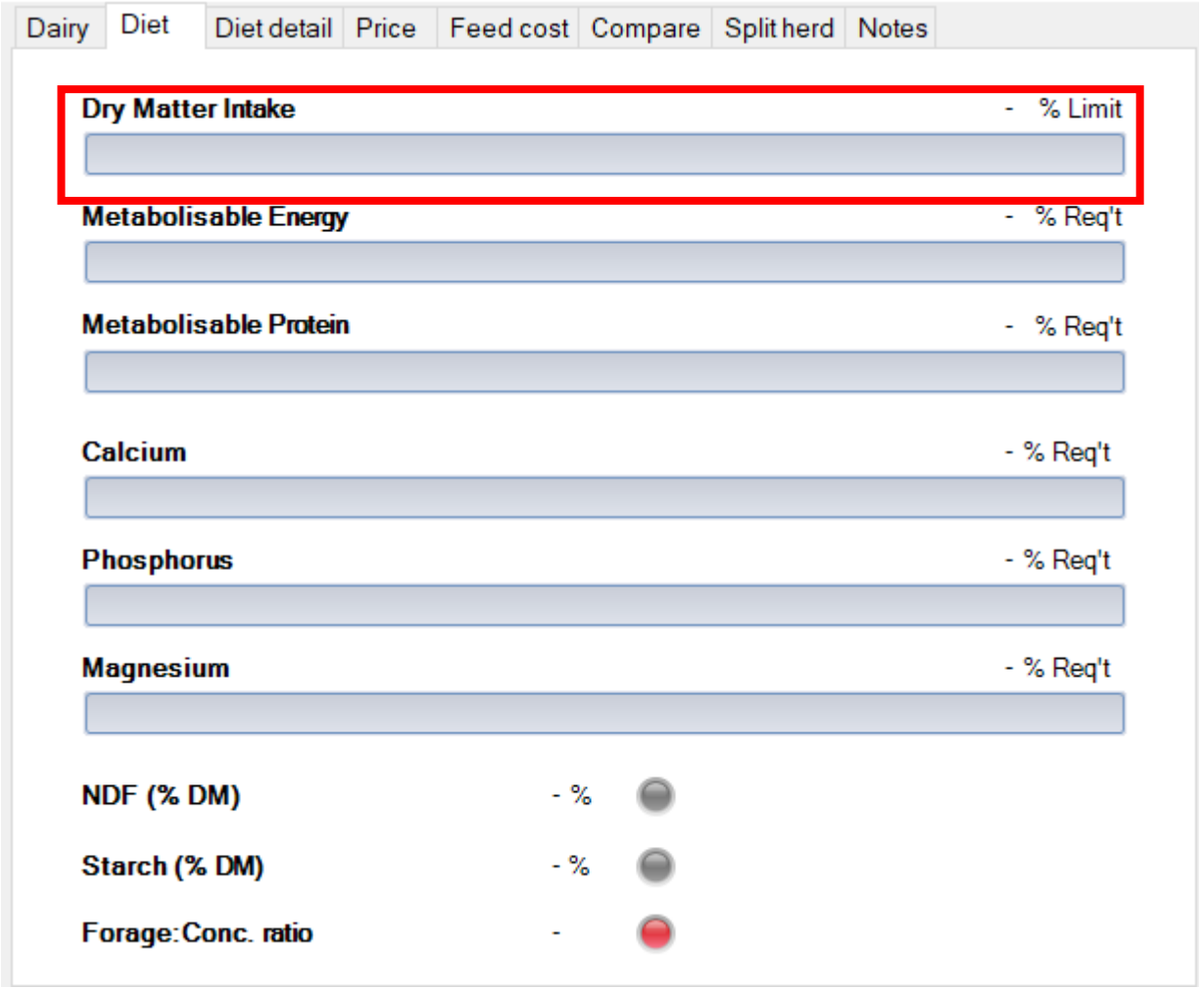
5.1 Diet tab Cont'd…

- The performance parameters that are shown on the screen are;
  - Dry matter intake -DMI
  - Metabolizable energy
  - Metabolizable protein
  - Mineral; Calcium, Phosphorus & Magnesium
  - NDF (%DM)
  - Starch (%DM)
  - Forage: Concentrate ration.



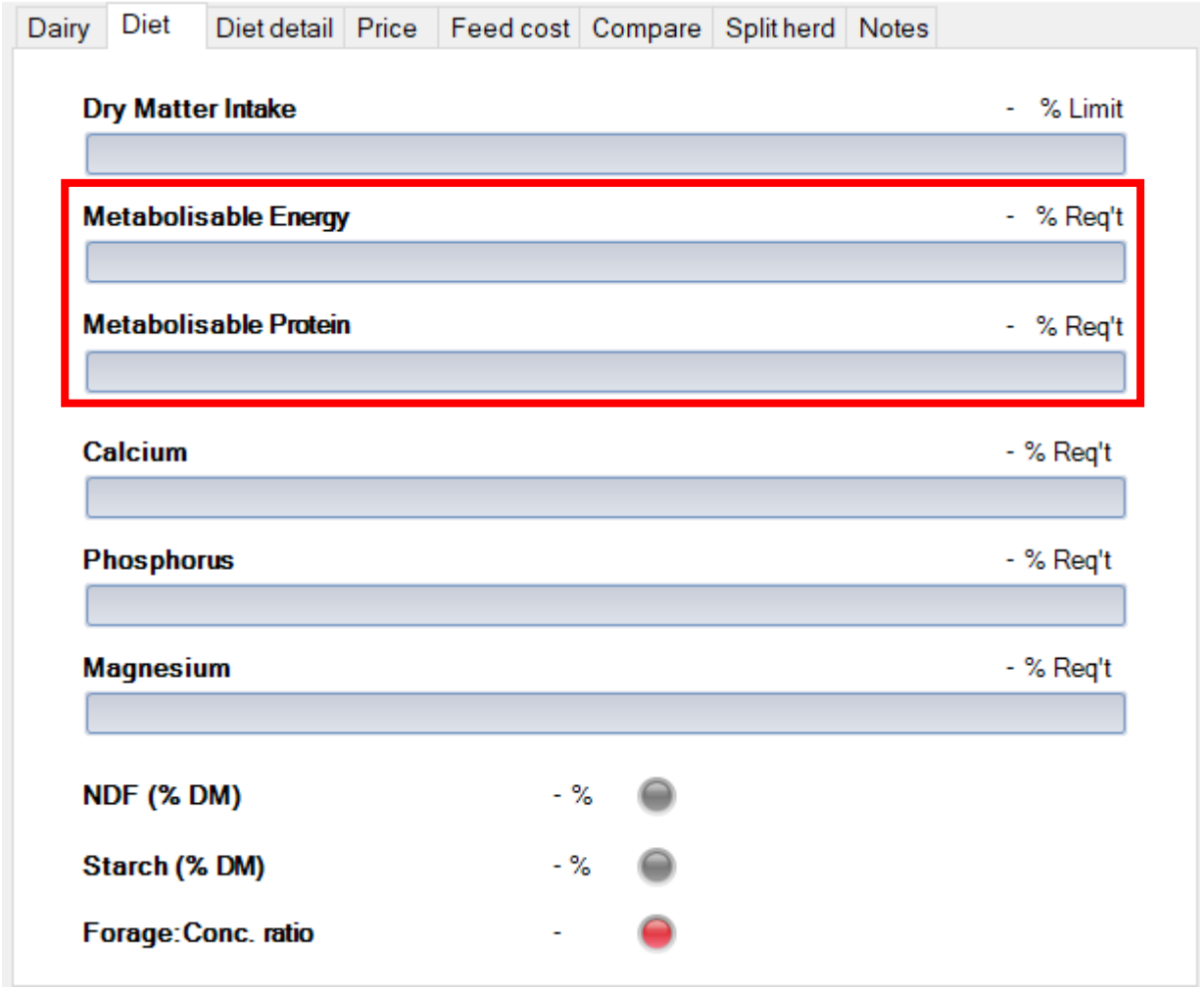
6. Dry matter intake

- Dry matter intake bar shows the percentage of DMI.
- If the cow is satisfied the DMI will be 100%.
- If the cow does not get enough feeds, DMI will be below 100%, and when DMI is more than 100% then it is unlikely the cow will be able to finish the ration.



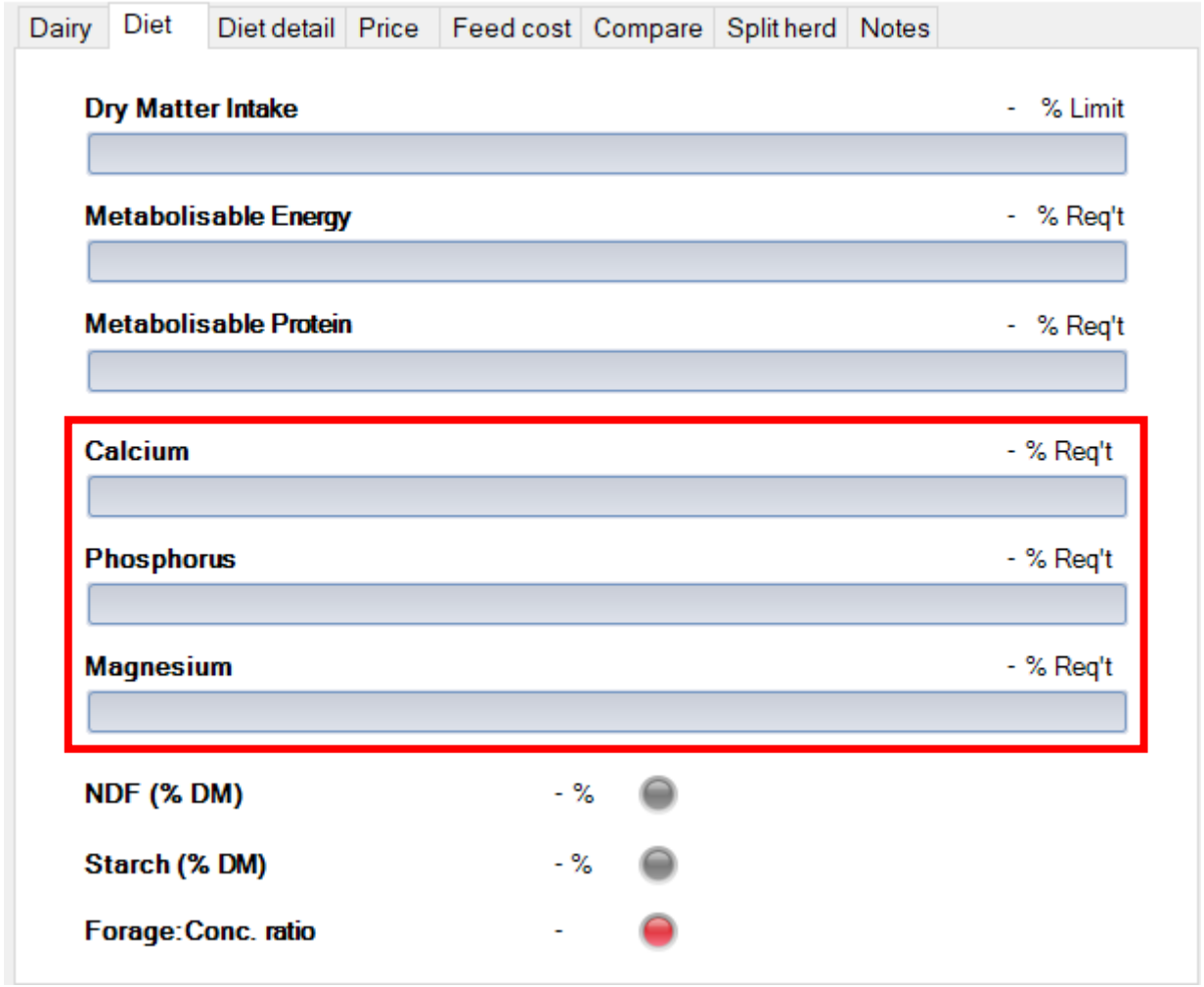
7. Metabolizable Energy and Protein

- These two progress bars show if the ration contains enough metabolizable energy and metabolizable protein to meet the animal's requirements.
- To balance the ration there needs to be a sufficient supply of both energy and protein in the ration.



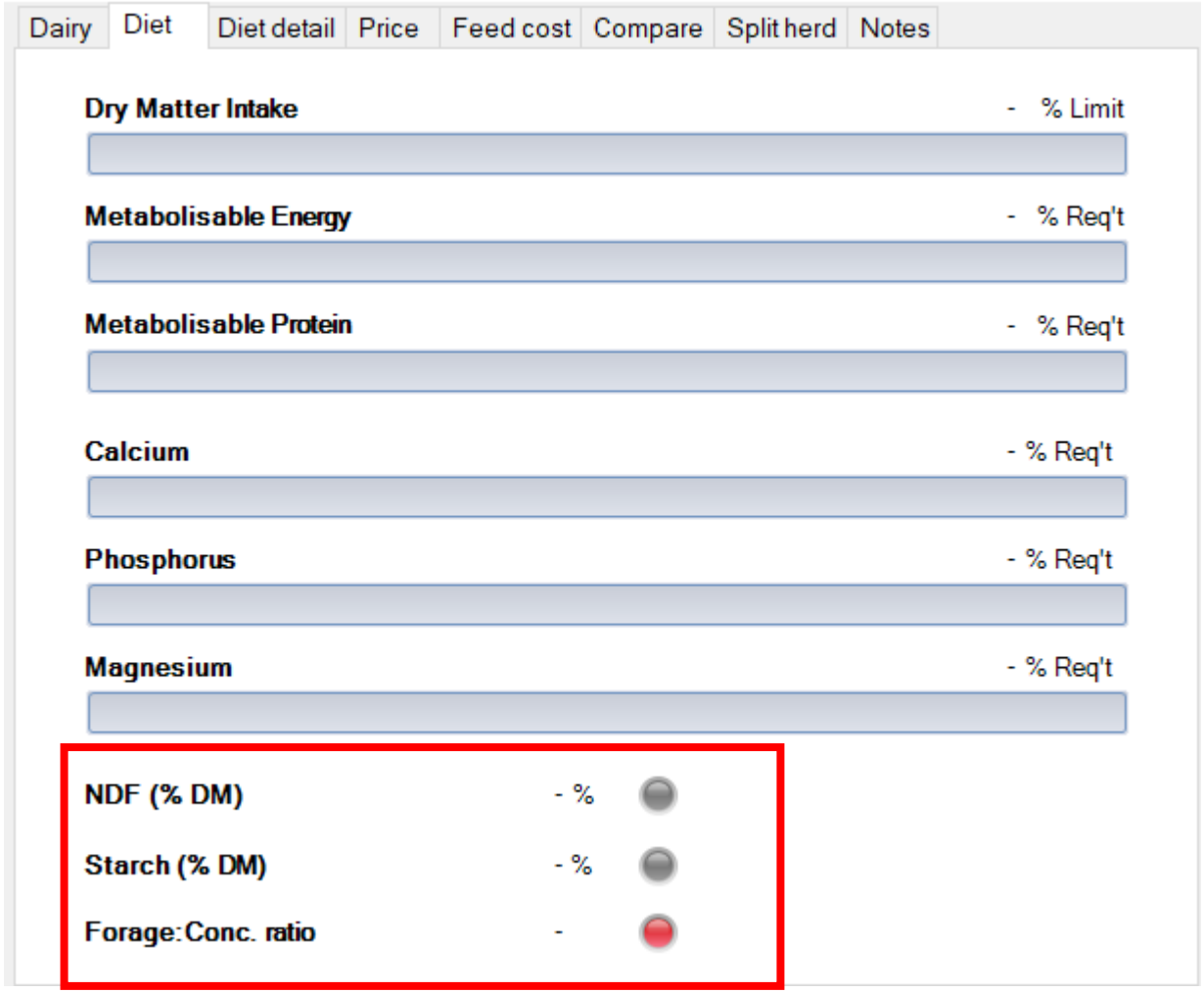
8. Minerals: Calcium, Phosphorus and Magnesium

- All feeds contain a certain amount of minerals. Based on the mineral content in your feed ingredients, Rumen8 calculates the total or accumulated amount of each mineral.
- Under the tab ‘Diet’, Calcium Phosphorus and Magnesium are visualized.
- If the feed ingredients do not meet the requirement for the different minerals then minerals or mineral mixtures can be added to the ration.
- If the feed ingredients exceed the requirements for the different minerals then adding minerals or mineral mixtures may not be necessary.



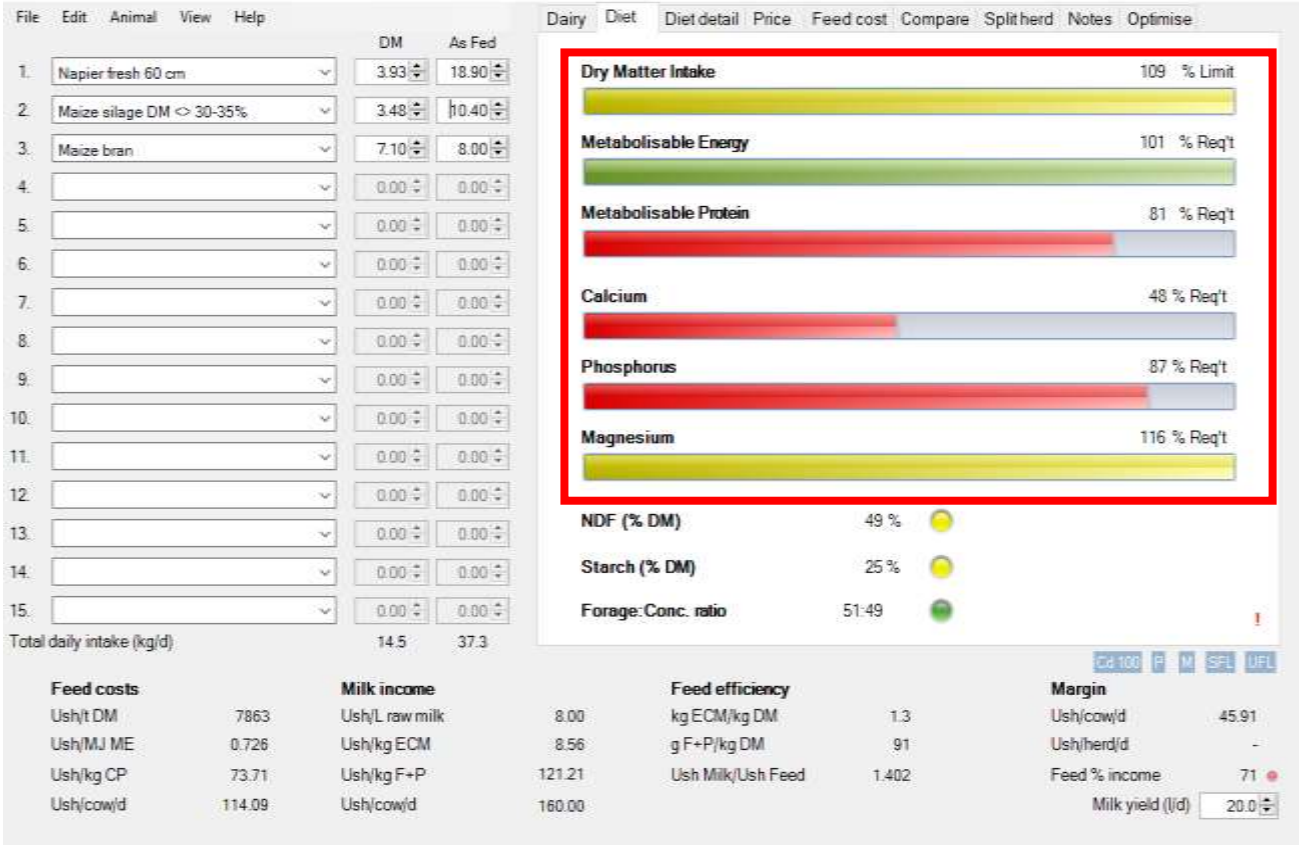
9. NDF, Starch and forage to concentrate ratio

- ‘NDF’ shows the amount of neutral detergent fiber as a percentage of dry matter (% DM) in the ration.
- ‘Starch’ shows the amount of starch as a percentage of dry matter (% DM) in the ration.
- Forage to concentrate ratio shows the ratio between forage and concentrate as a percentage in the ratio.



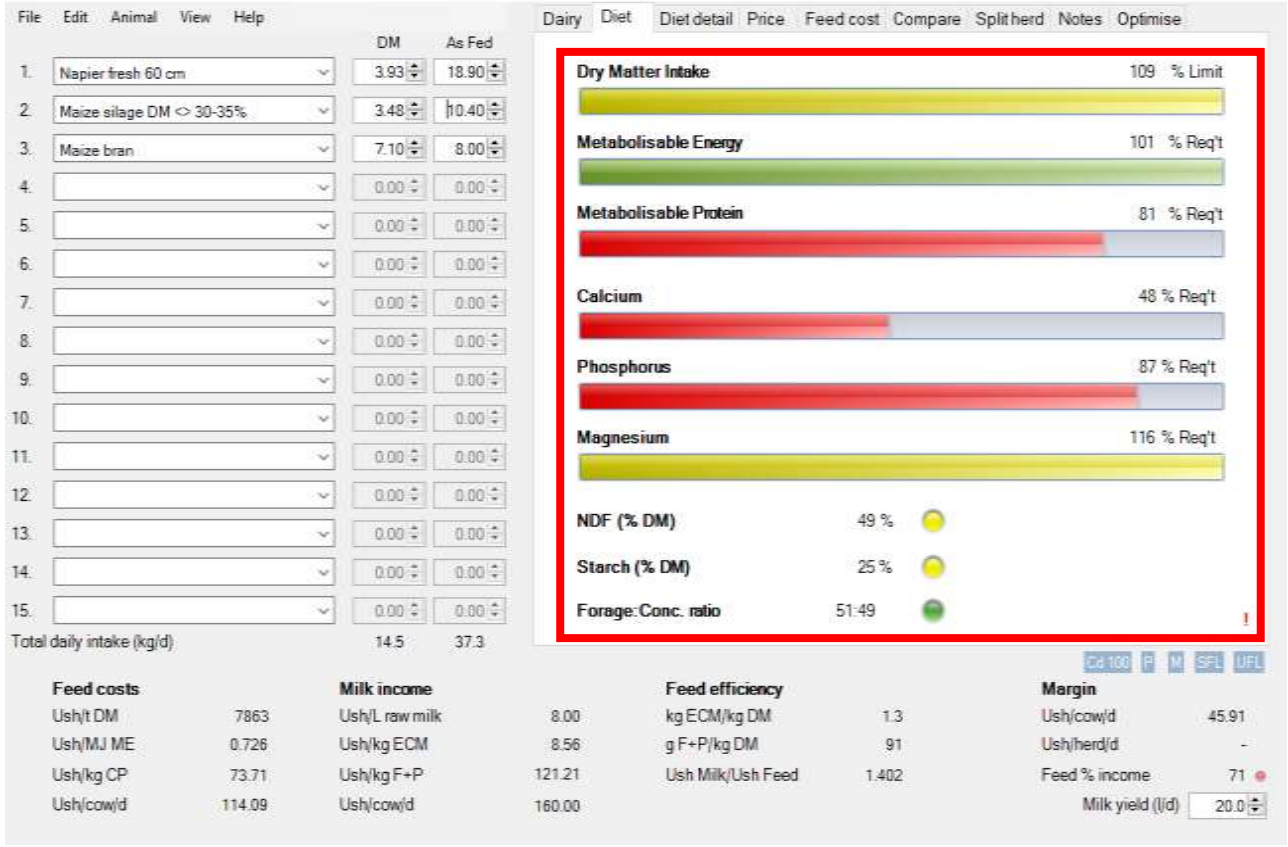
10. Ration calculation indicators

- When a ration is balanced in all the bars, the color green needs to be visible in the movable section of the bar. The meaning of the color code is as follows;
    - Red - under supply,
    - Green - meets the requirement/demand,
    - Yellow - Oversupply/exceeds the animal requirement.



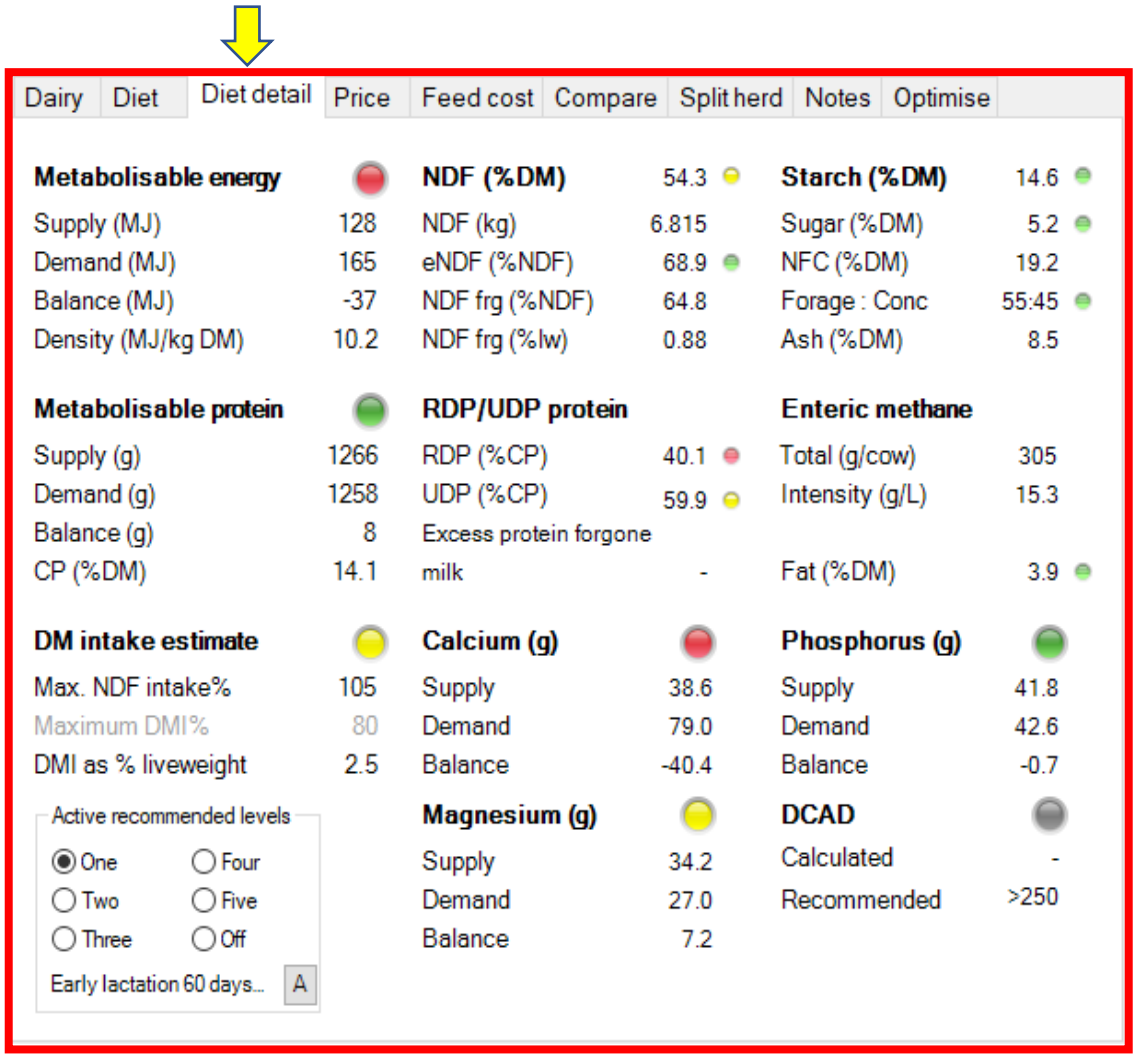
10.1 Ration calculation indicators Cont'd…

- Using the feed ingredients selected, you can edit the quantity 'As Fed' to achieve a balanced ration; or in pasture-based systems a ration that is as close as possible to a balanced ration.
- Rumen8 is a tool that can be instrumental to formulate a balanced ratio. However the tool does not generate money, neither does it know the (true) nutritional quality of the feeds available on the farm. It is up to the user of Rumen8 tool to enter accurate and reliable data on the nutritional quality of the feed ingredients.



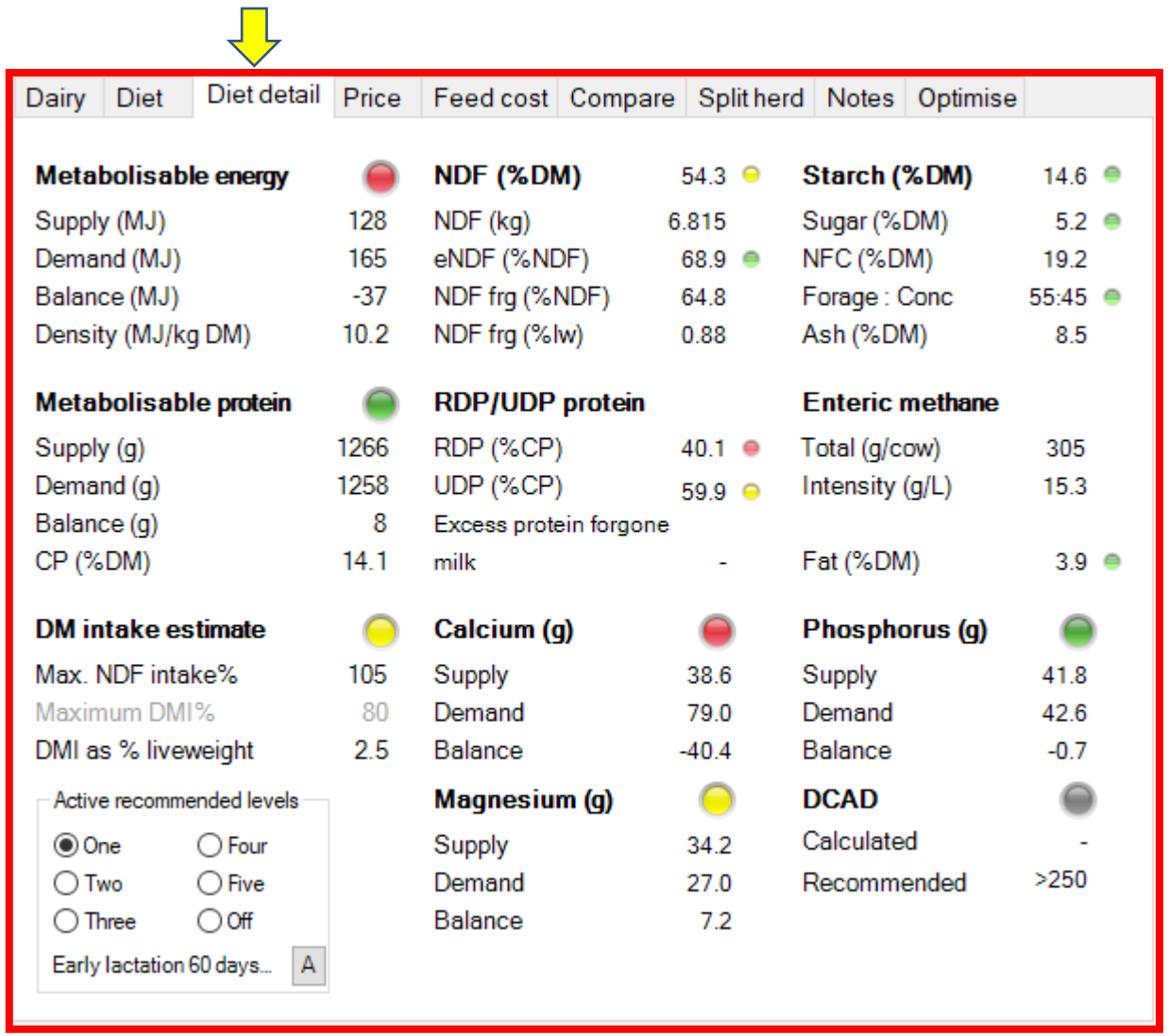
11. The ‘Diet detail’ tab

- The ‘Diet’ tab gives a good visual indication of how well the ration meets the individual cow requirements, but in a summarized overview.
- The ‘Diet Detail’ tab gives the specifications of the ration in greater detail.
- It is recommended that an animal nutritionist is consulted when interpreting these parameters.



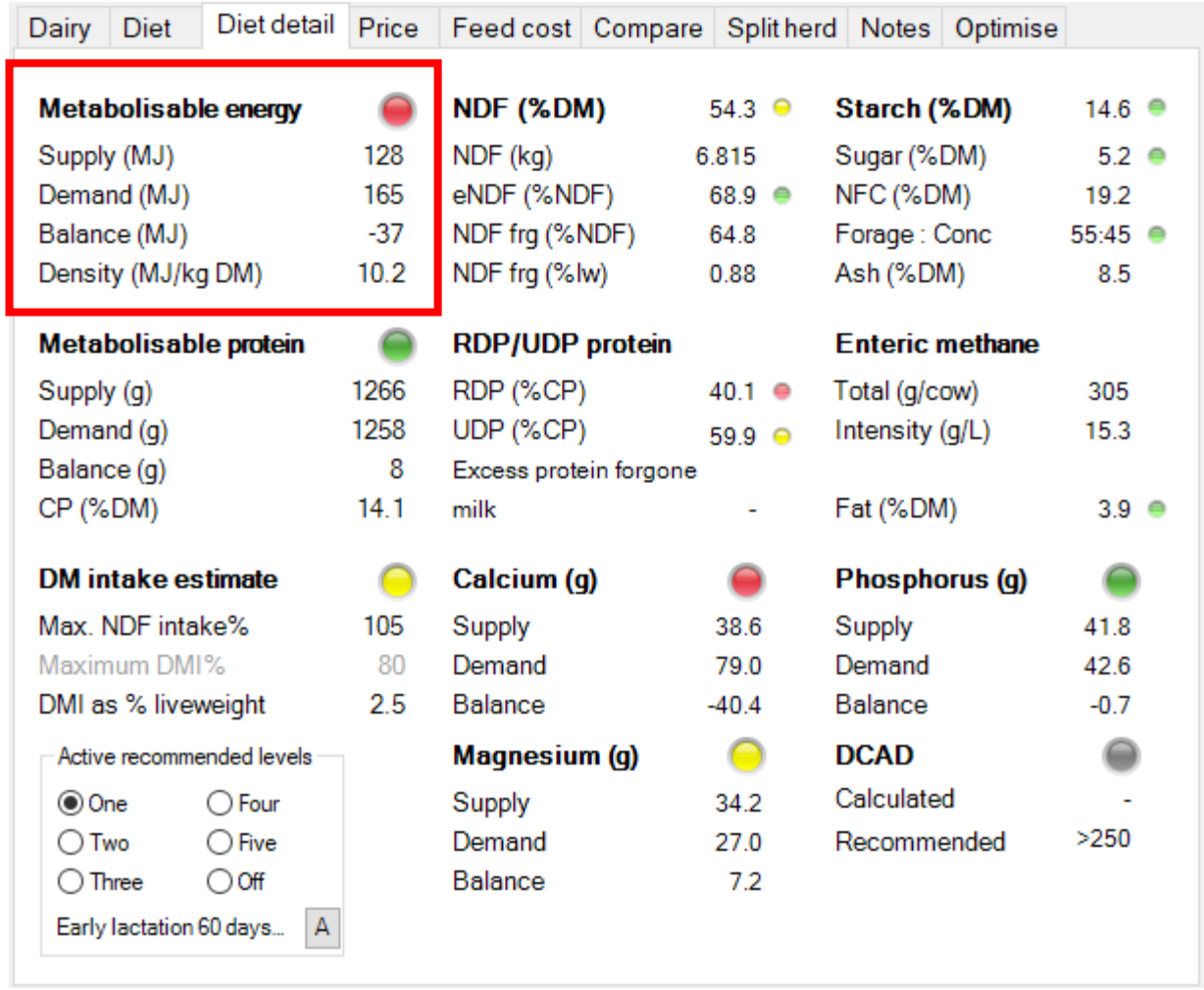
11.1 The ‘Diet detail’ tab Cont’d…

- Rumen8 displays the calculated amounts of ingredient/s in supply, demand, balance, and density or percentage of the diet.
- The supply is the total amount of nutritional value of the diet supplied in the diet.
- The demand shows the amount of nutritional value needed by that specific cow.
- The balance is the difference between the demand and the supply.
- To understand each information in this tab, hold your cursor/pointer on the specific item.



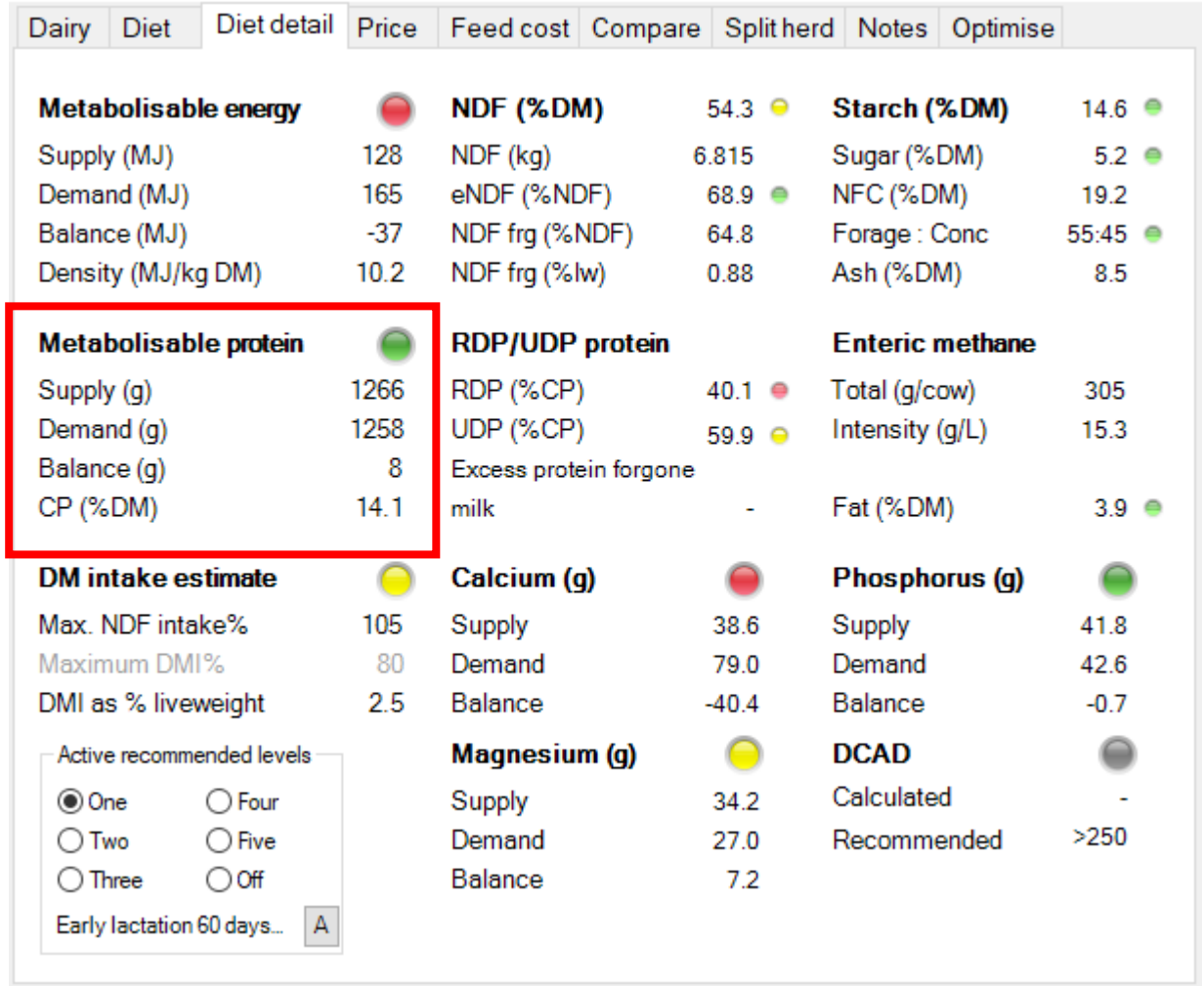
12. Metabolizable Energy

- The metabolizable energy (ME) is the main measure used to describe the energy requirements of the animal and the energy supplied in feeds.
- It is the energy remaining after gas, fecal and urinal energy have been accounted for.
- In this case the ration has the following details on the ME;
  - Supply (MJ): 128
  - The 'Demand' (MJ): 165
  - The difference between the Demand and supply is the 'Balance' (MJ): - 37
  - The Density (MJ/Kg DM) of the ration is 10.2.



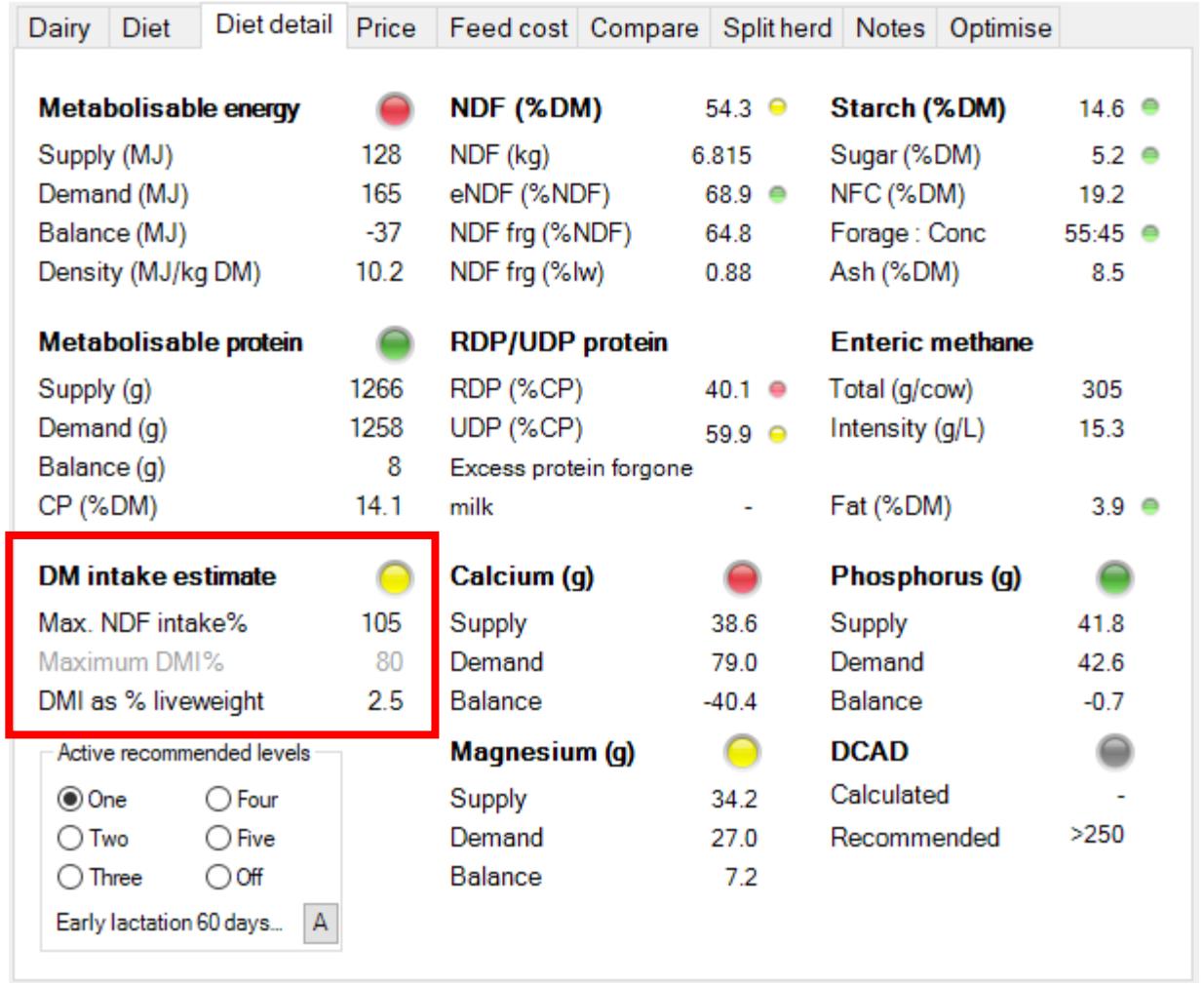
13. Metabolizable Protein

- Metabolizable protein (MP) refers to the true protein absorbed from the small intestine and is available for metabolism.
- MP in ruminants is derived from two sources; microbial protein synthesized in the rumen and dietary proteins that escape rumen degradation.
- This is the measure of the supply of protein in the ration. According to the current ration the demand has been met, hence the color green.
  - Supply (g): 1266
  - Demand (g): 1258
  - Balance (g): +8
  - Crude (CP) % DM: 14.1



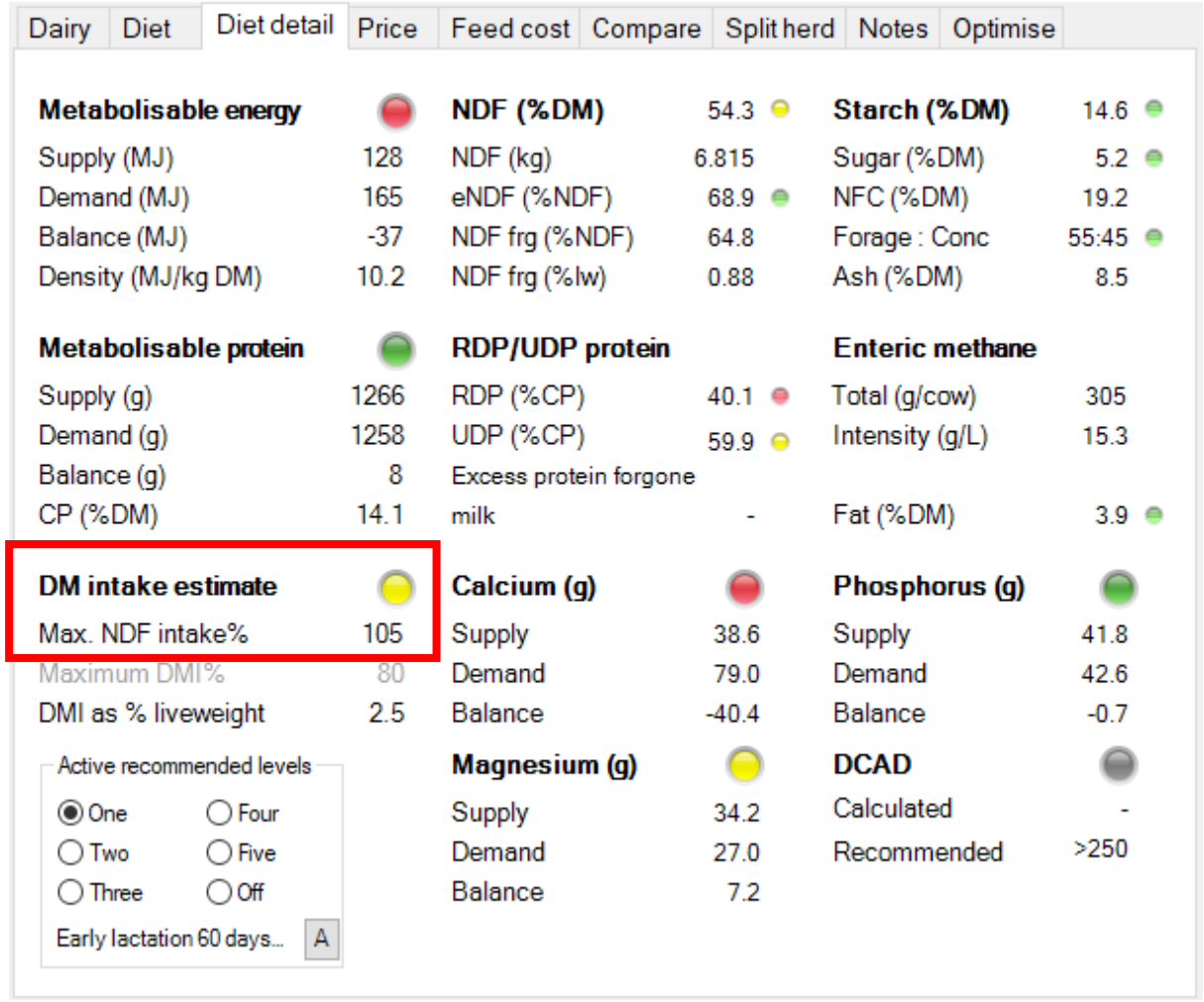
14. DM Intake estimate

- Rumen8 has two alternatives to estimate DMI. The method best suited to the current animal is selected in the ‘Animal Tab’.
- Estimating how much a cow can eat per day is important when formulating rations. Estimating DMI is complex because of the many factors that affect the feed intake capacity of a dairy cow.



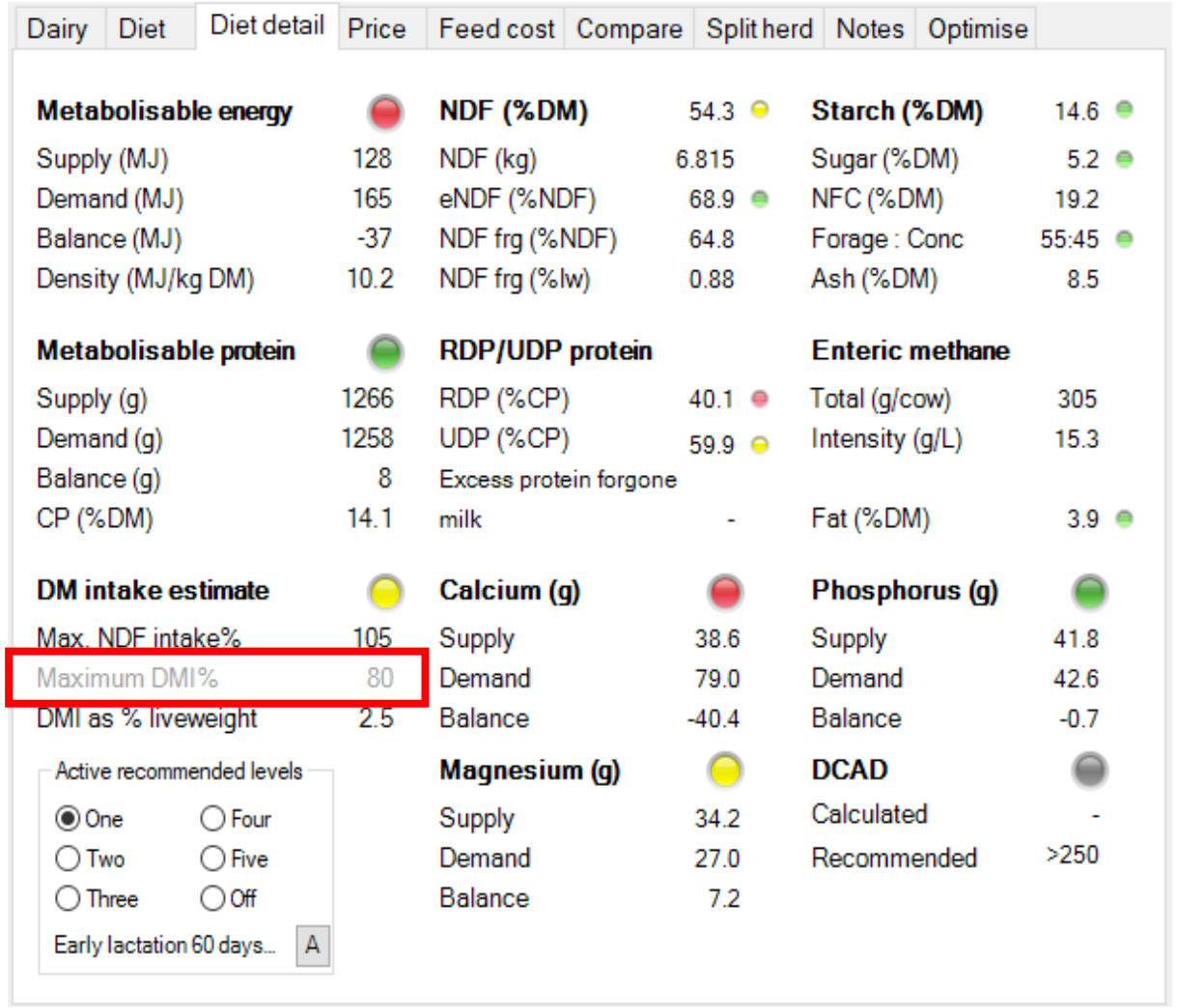
14.1 Maximum NDF intake %

- Maximum NDF intake % is the intake estimate that can be adjusted by the user, by changing the intake of NDF as a percentage of the animal's live weight.
- Rumen8 assumes a default value of NDF intake of 1.2% of body weight.
- For dairy cows in the tropics (East Africa), NDF at about 1.3% of body weight may be a better estimator of DMI than the conventional method.
- However, DMI is a complex matter and where possible, intake should be weighed, and assumed intake should be replaced by the observed intake.
- In the 'Diet detail' tab of Standard mode, the percentage of maximum DMI in the 'Conventional method' is shown next to the 'NDF method'.



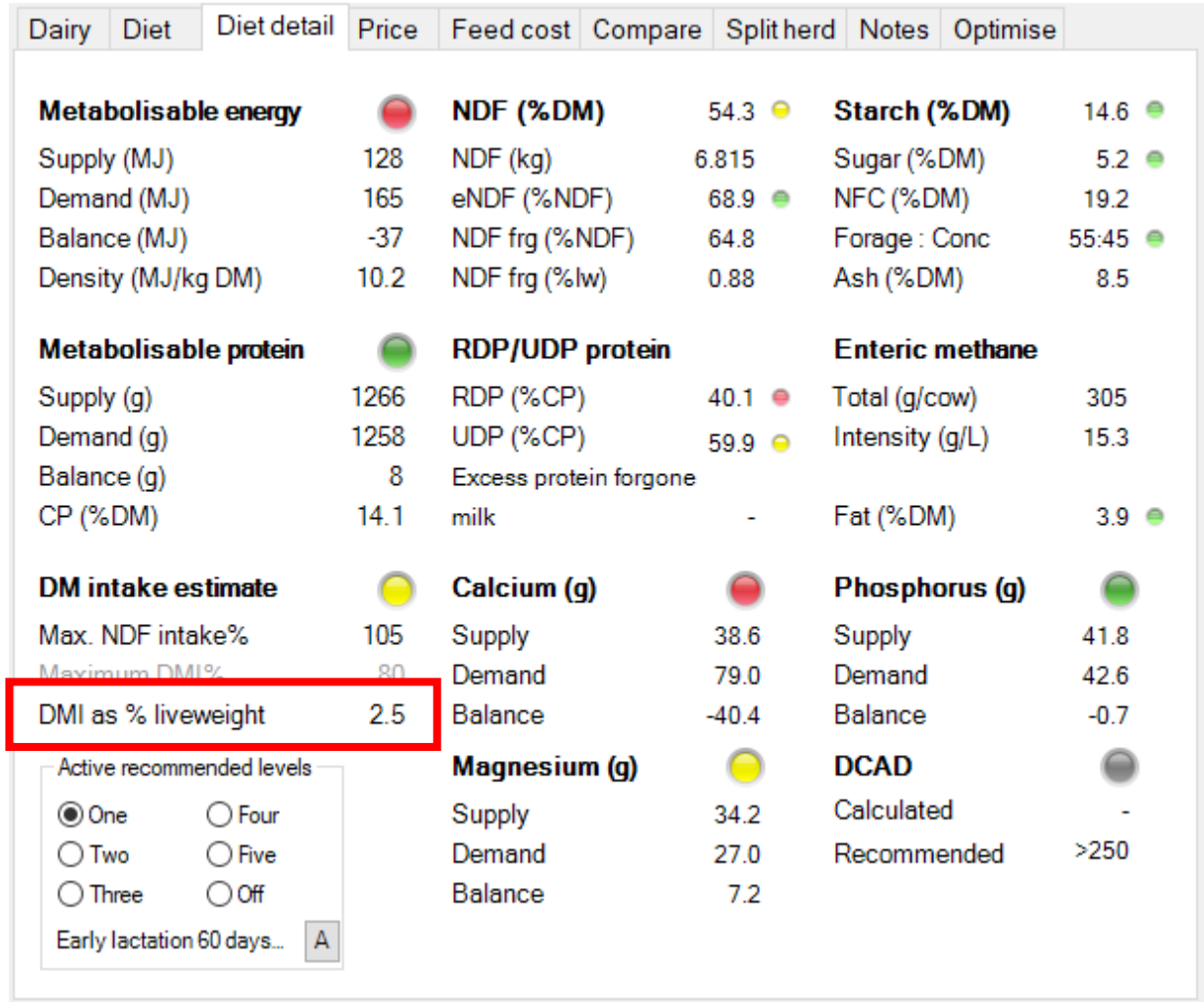
14.2 Maximum DMI %

- Maximum DMI % is the predicted maximum intake currently provided by the diet based on live weight, milk yield and stage of lactation for cows (NRC 2001).
- A fixed amount for dried and transition cows is set in the ‘Preferences’, or for heifers on live weight and concentrate fed (AFRC 1993).
- When NDF intake is used as a dry matter intake estimation method, then this function is not active hence the faint/grey color.



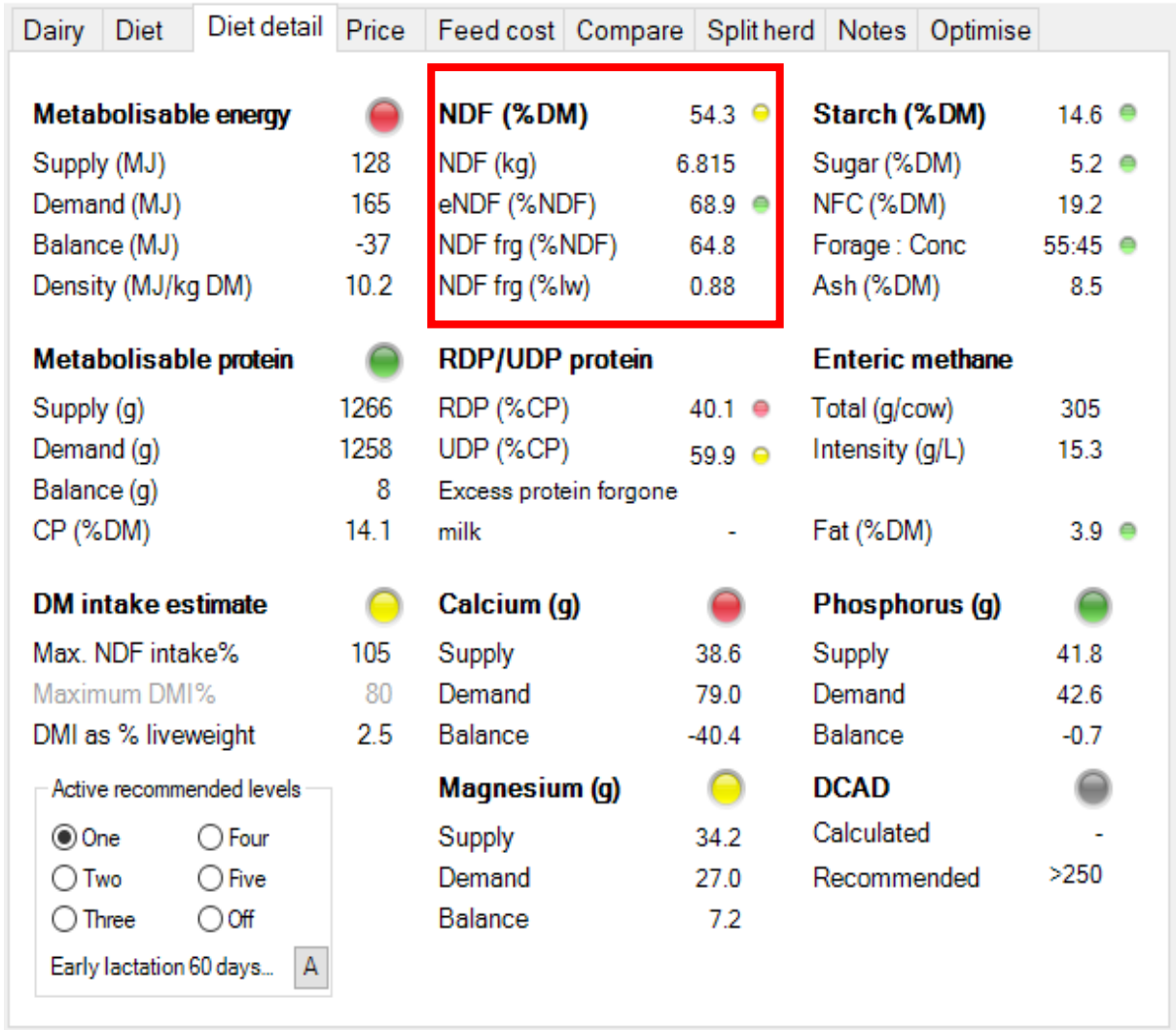
14.3 DMI as % liveweight

- DM intake as % live weight is the dry matter intake expressed as a percentage of the live weight of the animal.



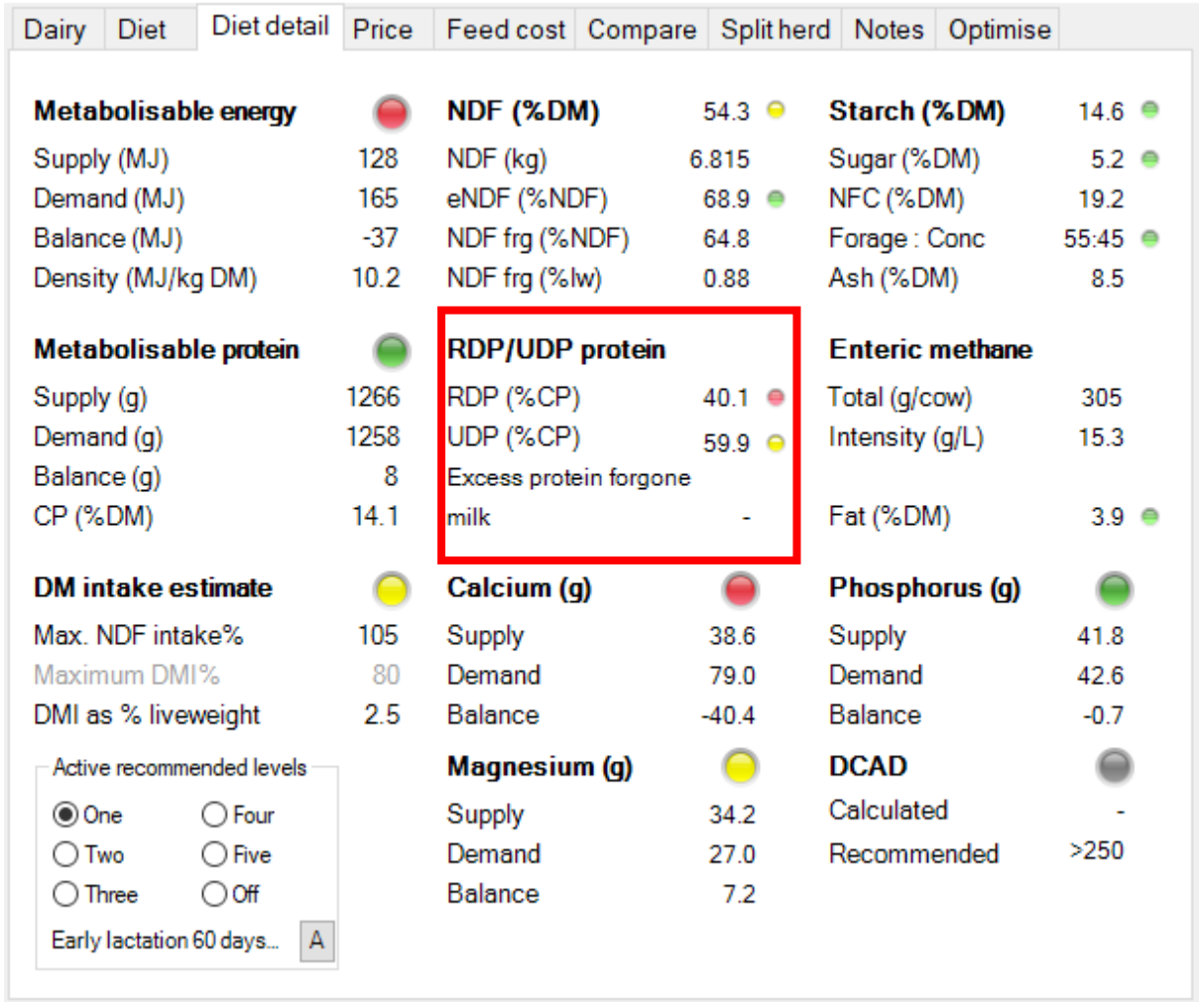
15. NDF (% DM)

- The function shows the percentage of NDF in the ration. For this case, 54.3% (color yellow shows it exceeding the recommended levels) of NDF in the total DM of the ration.
- NDF (Kg) - the quantity in kilograms of NDF in the ration i.e. 6.815 kg.
- The eNDF (%NDF) 68.9, is the percentage of NDF that is deemed effective i.e. that leads to rumination (% OF NDF).
- NDF frg (%NDF) 64.8, is the NDF in the ration supplied from forage as a percentage of total NDF.
- NDF frg (%lw) 0.88, is the NDF in the ration supplied from forage as a percentage of live weight.



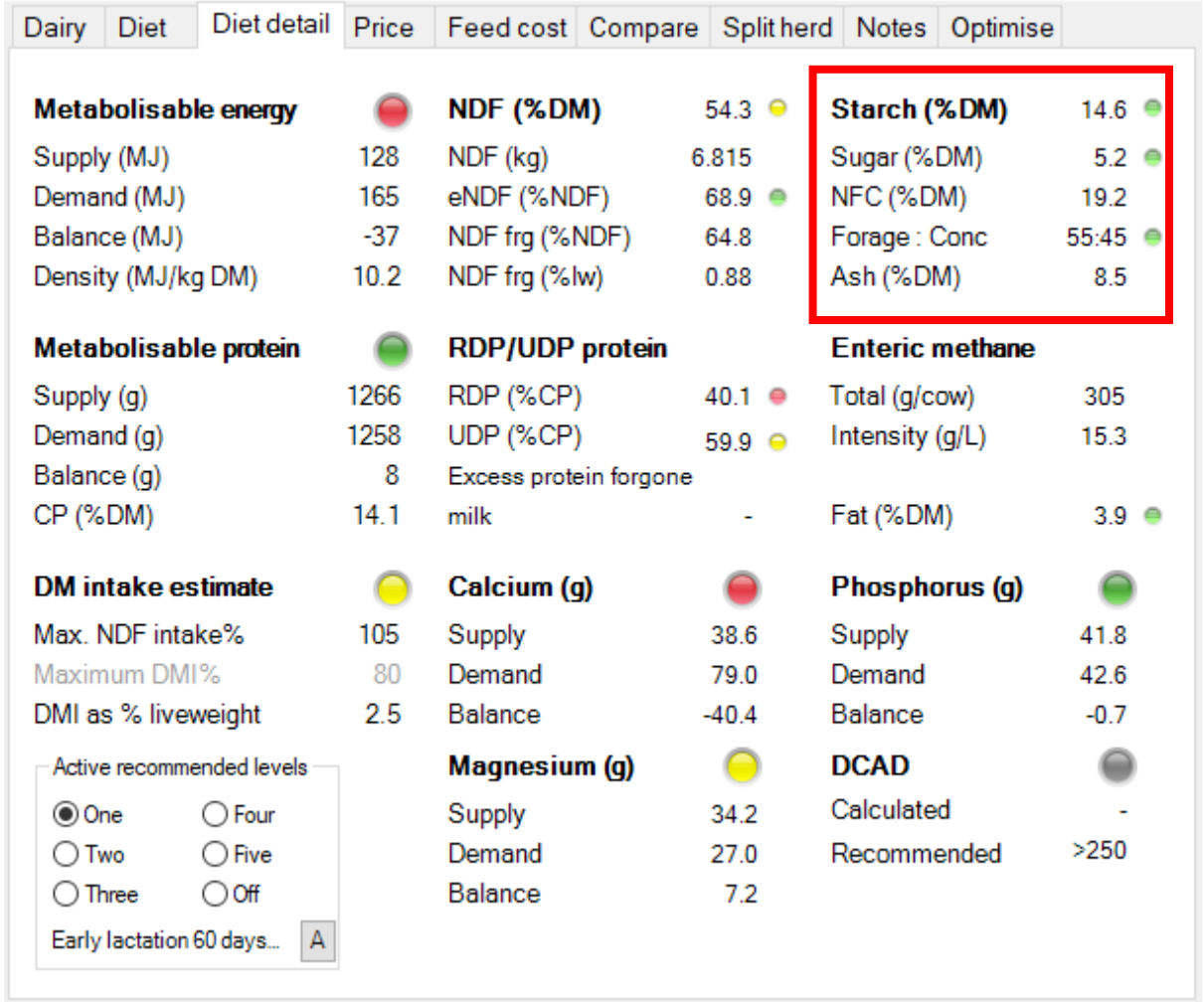
16. RDP/UDP protein

- RDP (Rumen Degradable Protein) and UDP (Undegraded Dietary Protein) are viewed as percentage in the ration as follows;
    - RDP (%CP) 40.1 – this is the percentage of the dietary Crude protein that is rumen degradable.
    - UDP (%CP) 59.9 – this is the percentage of the dietary Crude protein that is not degraded in the rumen.



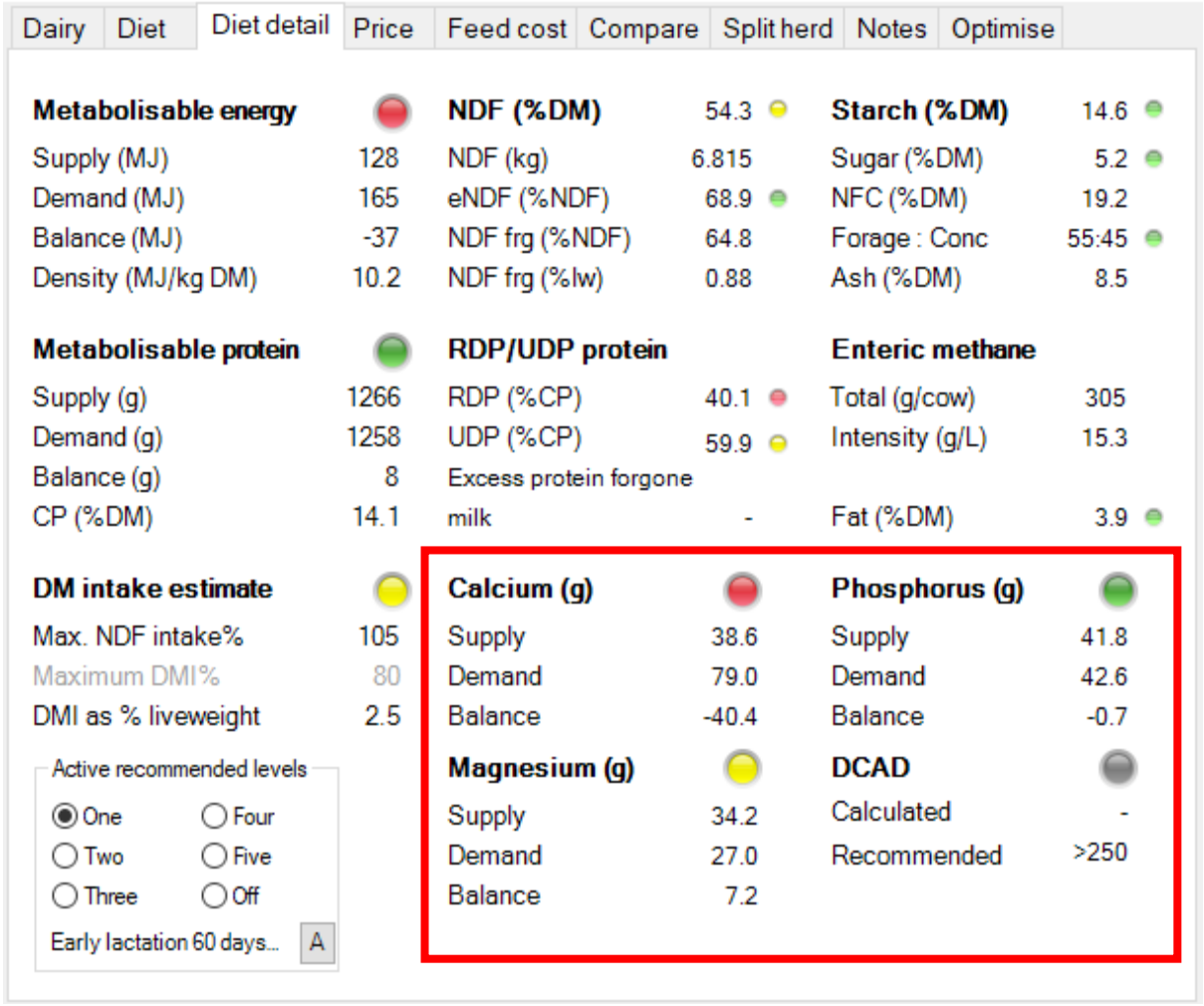
17. Starch (% DM)

- Starch is an energy source for the animal, found in the grain, leaf, stem and bulbous roots of some fodder crops.
- Sugar (%DM); 5.2 - Sugar in the ration in the percentage of DM.
- NFC (%DM); 19.2 - Total non-fibrous carbohydrates in the ratio in percentage DM.
- Forage : Concentrate (55:45) - This is the percentage ratio of forage to concentrate in the ration.
- Ash (%DM) 8.5 - The percentage of inorganic matter in the ration.



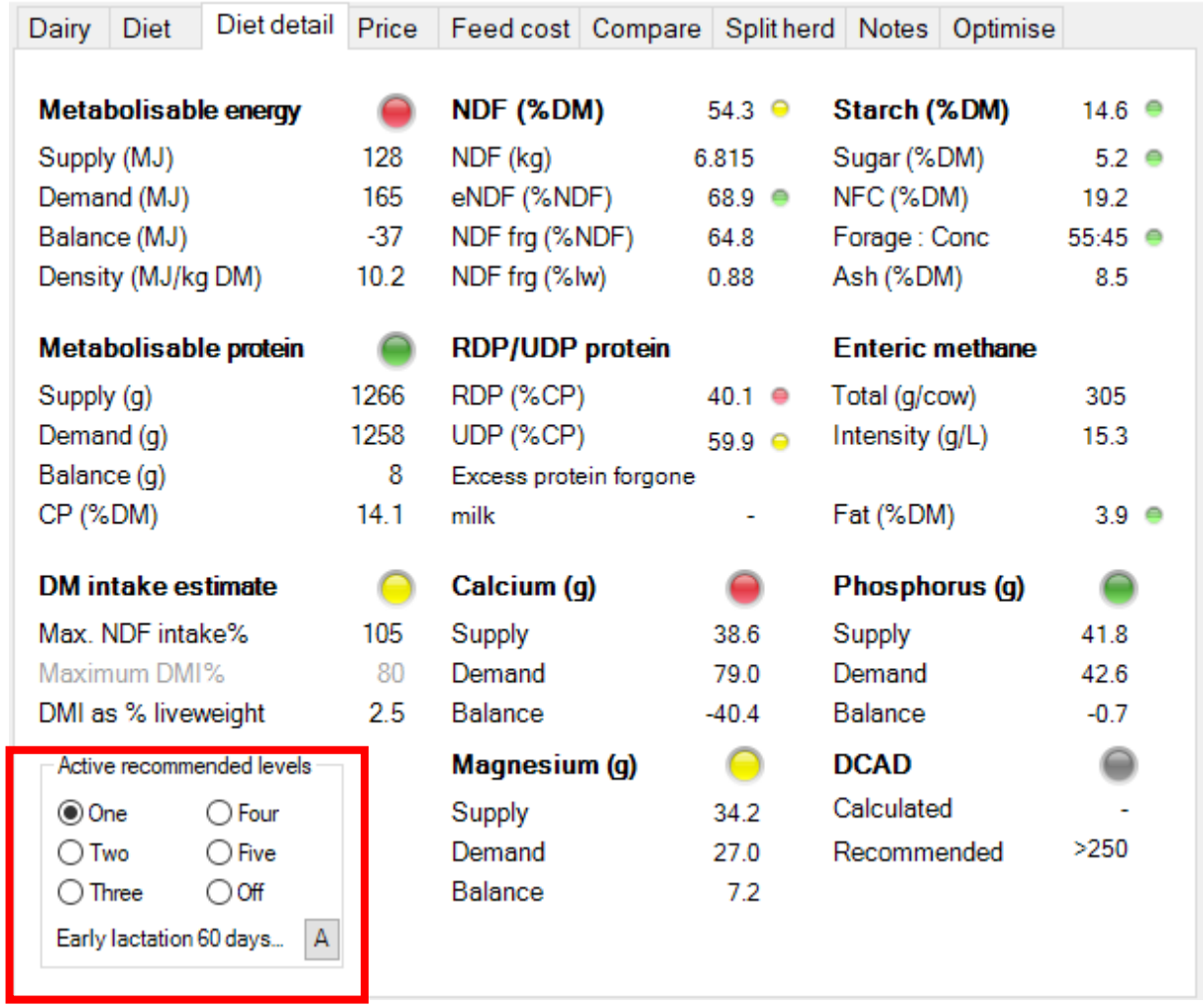
18. Minerals

- The diet detail shows more information about the minerals in the ration.
- The calculation is based on the mineral content in your feeds ingredients. Rumen8 calculates the total or accumulated amount of each mineral.
- The red box shows the amount supplied, demanded by the animals and the balance.



19. Active Recommended levels

- You can choose which set of recommended levels to used for your animals.
- Up to five sets of recommended levels can be set in preferences and switched between here.
- For example, the minimum and maximum level for dietary NDF% and starch% could be set for early, mid and late lactation respectively).
- The small warning lights for the parameter with recommended levels will appear (red, green and yellow).



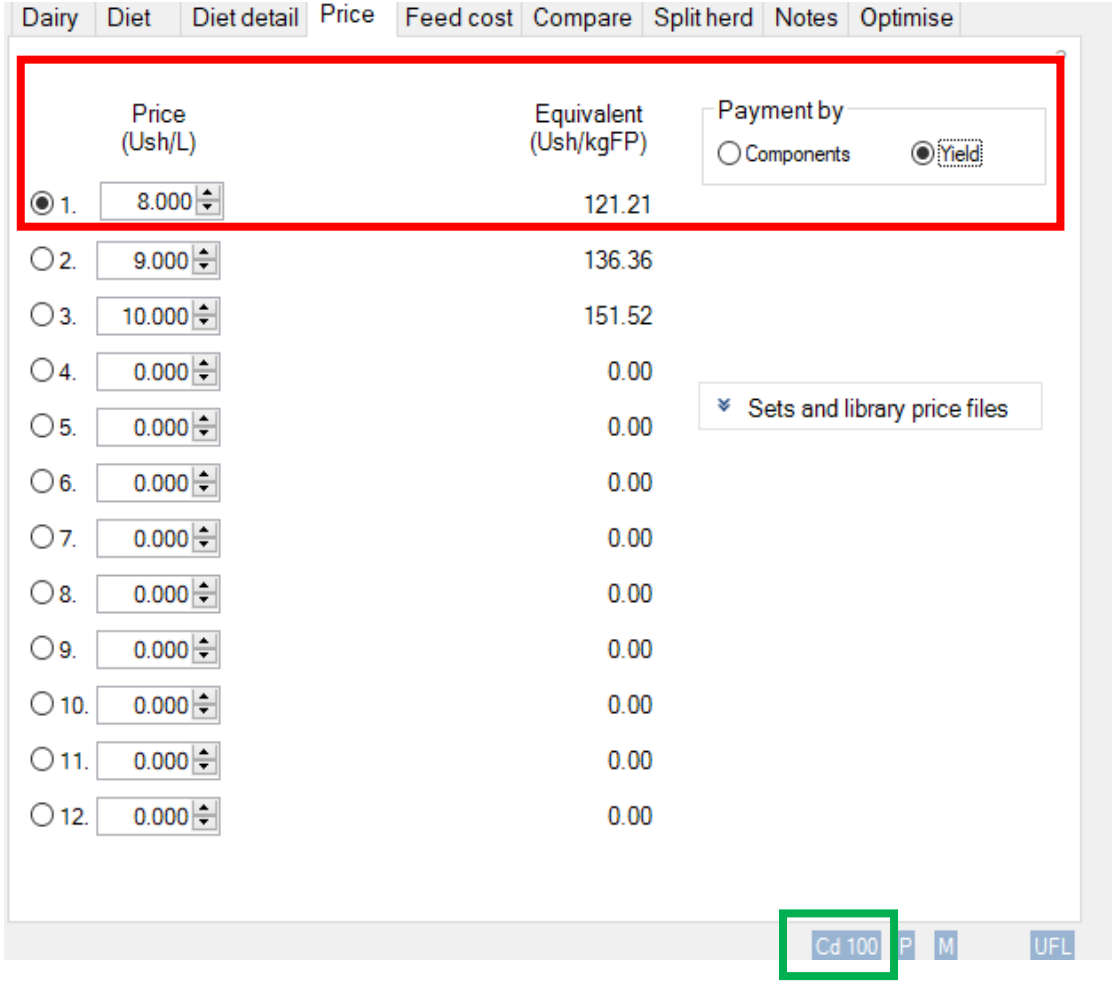
20. The ‘Price’ tab

- The milk Price tab lets you enter the price of milk per liter. There are two payment options;
  - by ‘Components’ (quality and quantity of milk e.g butter fats, protein, etc.) and
  - by ‘Yield’ (quantity).

- You can input 12 prices that you can keep on switching depending on your preference.
- For the choice of currency you can select your most preferred from the tab ‘File’>> ‘Preference’ section.

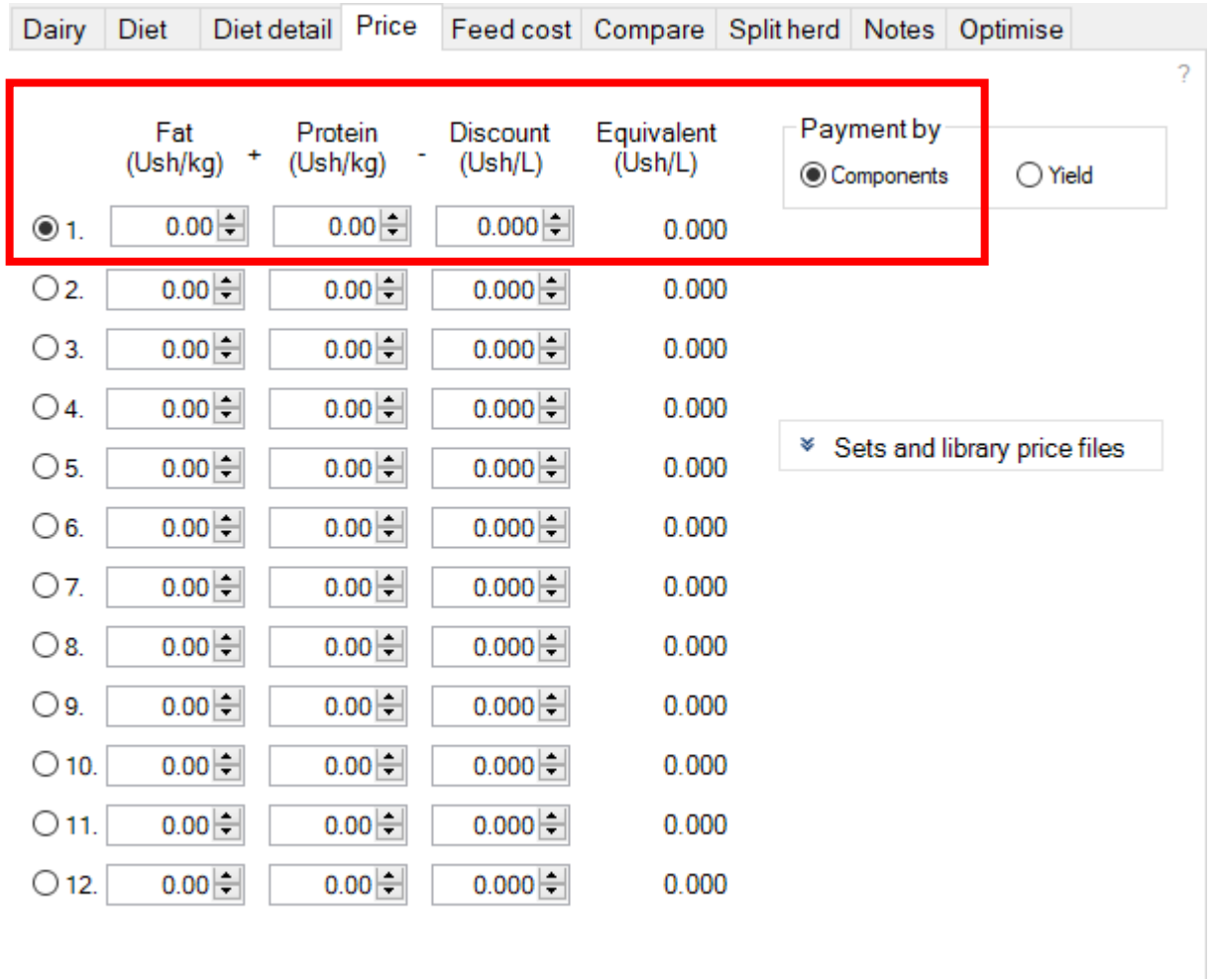
*Note: For all prices in this example the currency divisor 100 (green box) – example ‘1’ a liter of milk is Ush.800 but entered ad Ush.8

- The best option to use if you are not paid by quality of milk is Option ‘Yield’ (red box).



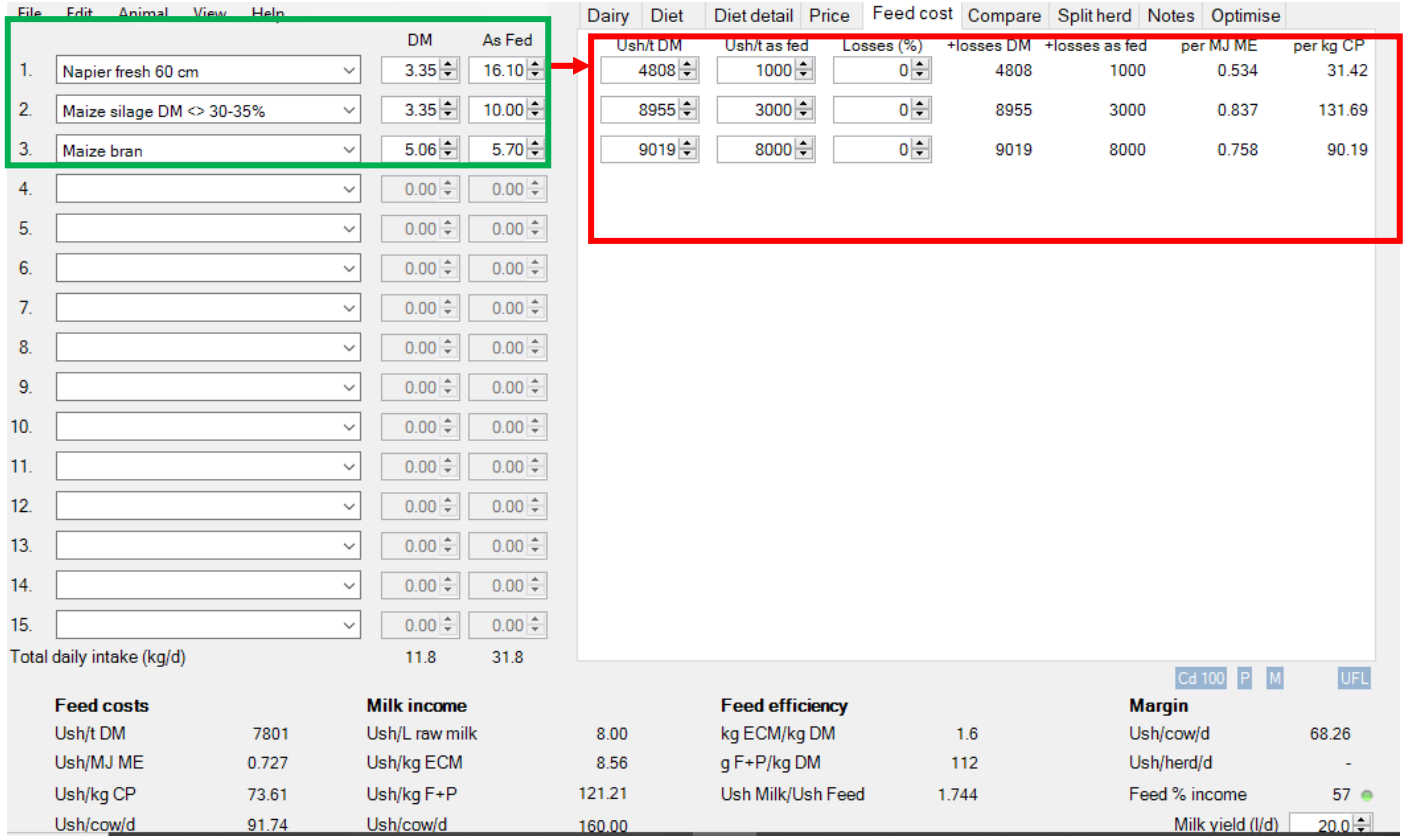
20.1 The ‘Price’ tab Cont’d…

- This option ‘Components’ (ticked) only applies to those farmers paid by their milk processors for the quality of the milk (Amount of milk fat and amount of milk protein with possibly a discount for volume).
- In this case under the tab ‘Price’, ‘Payment by’ is changed from ‘Yield’ to ‘Components’.



21. The ‘Feed cost’ tab

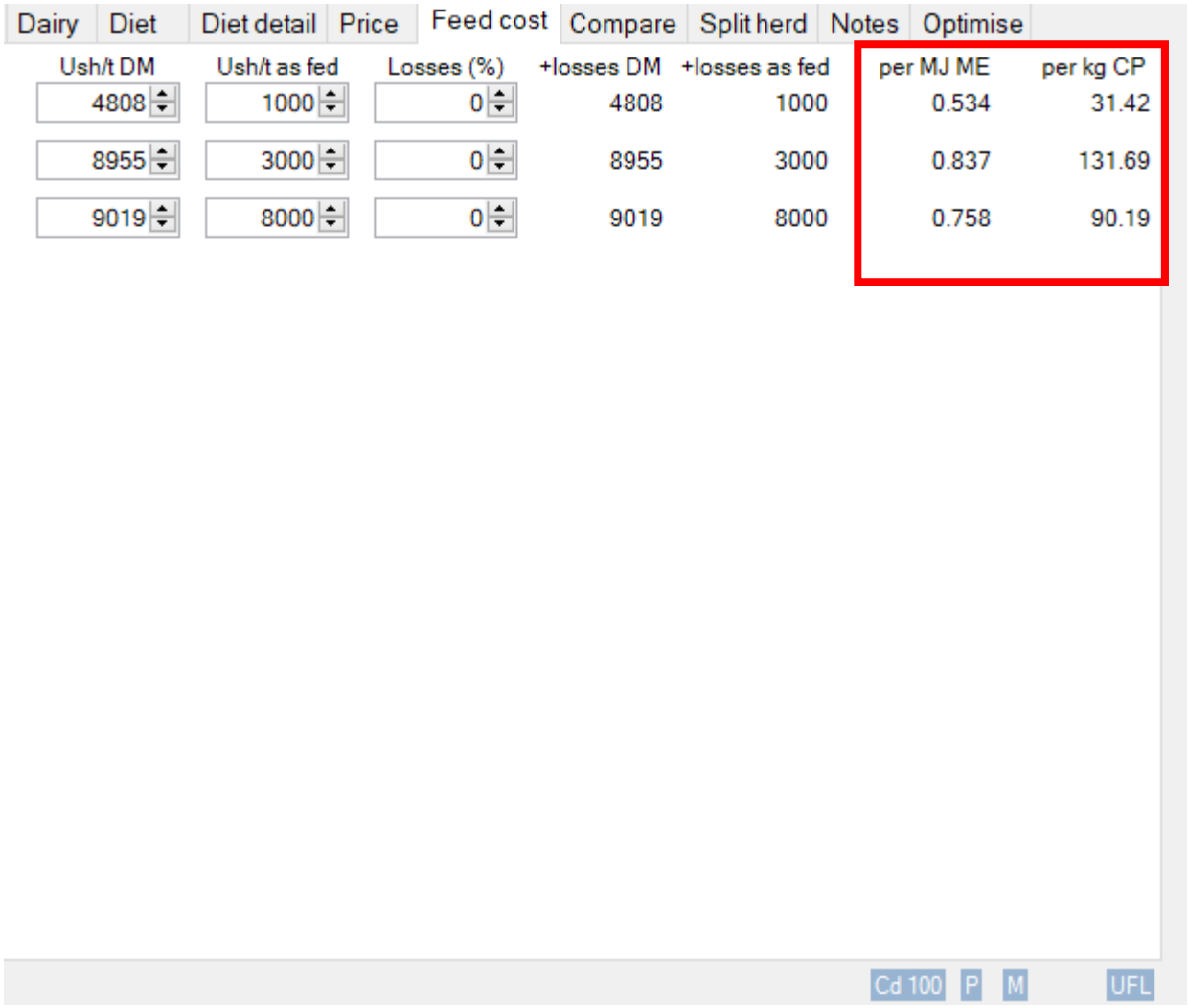
- Feed costs as well as feed losses can be viewed and altered on this tab. Please note that a Margin (MAFC) can only be calculated when all diet ingredients have cost buy one ton of feeds.
- Costs can be entered or altered on the feed cost page and in all user feed libraries, except the Shared Feed Library.
- When changing the feed cost(Ush/t) or losses (%) on the feed cost page, the cost or losses will also change in the User feed library you are working on.
- Costs and losses of the Diet ingredients used can also be viewed under ‘Diet ingredients’ on the left half of the page in the red box.



21.1 The ‘Feed cost’ tab Cont’d…

- This section shows the cost per ton of each ration ingredient as fed used in the ration.
- The prices of the feed ingredient is further broken down into;
  - Price per ton of dry matter (DM).
  - Price per megajoules of metabolizable energy (MJ M).
  - Price per kilogram of crude protein (per Kg CP).
- It is possible to edit the cost of the feeds here to match your current prices.

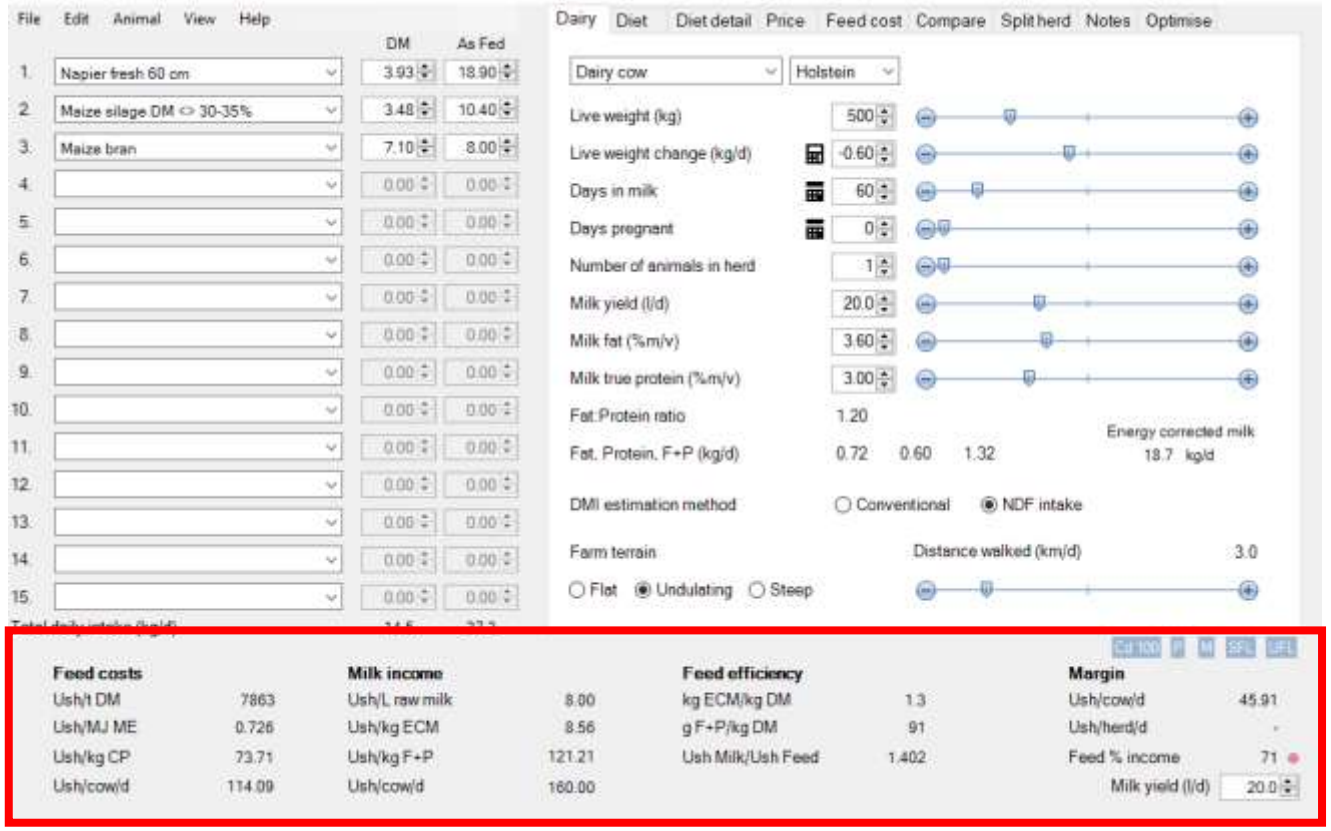
*Note: For all prices in this example the **currency divisor 100.**



22. More Price calculations

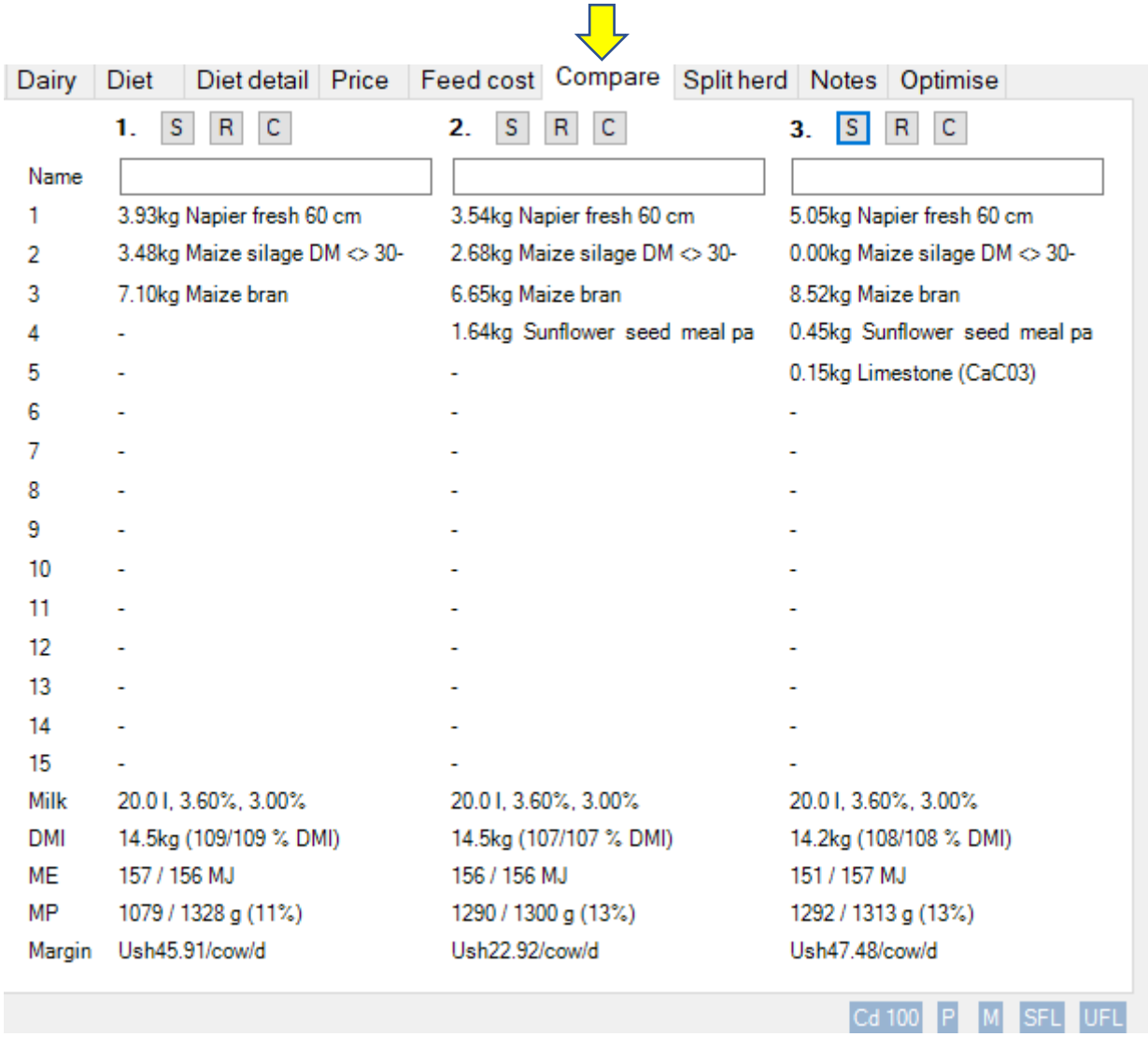
- The bottom section shows financial information.
- The rightmost column displays the margin (milk income- feed costs).
- To the left are detailed feed costs and income along with measures of efficiency.
- At the bottom right corner there is a milk yield adjustment that you can find useful when you are playing around to get the ration just right.

*Note: For all prices in this example the currency divisor 100.



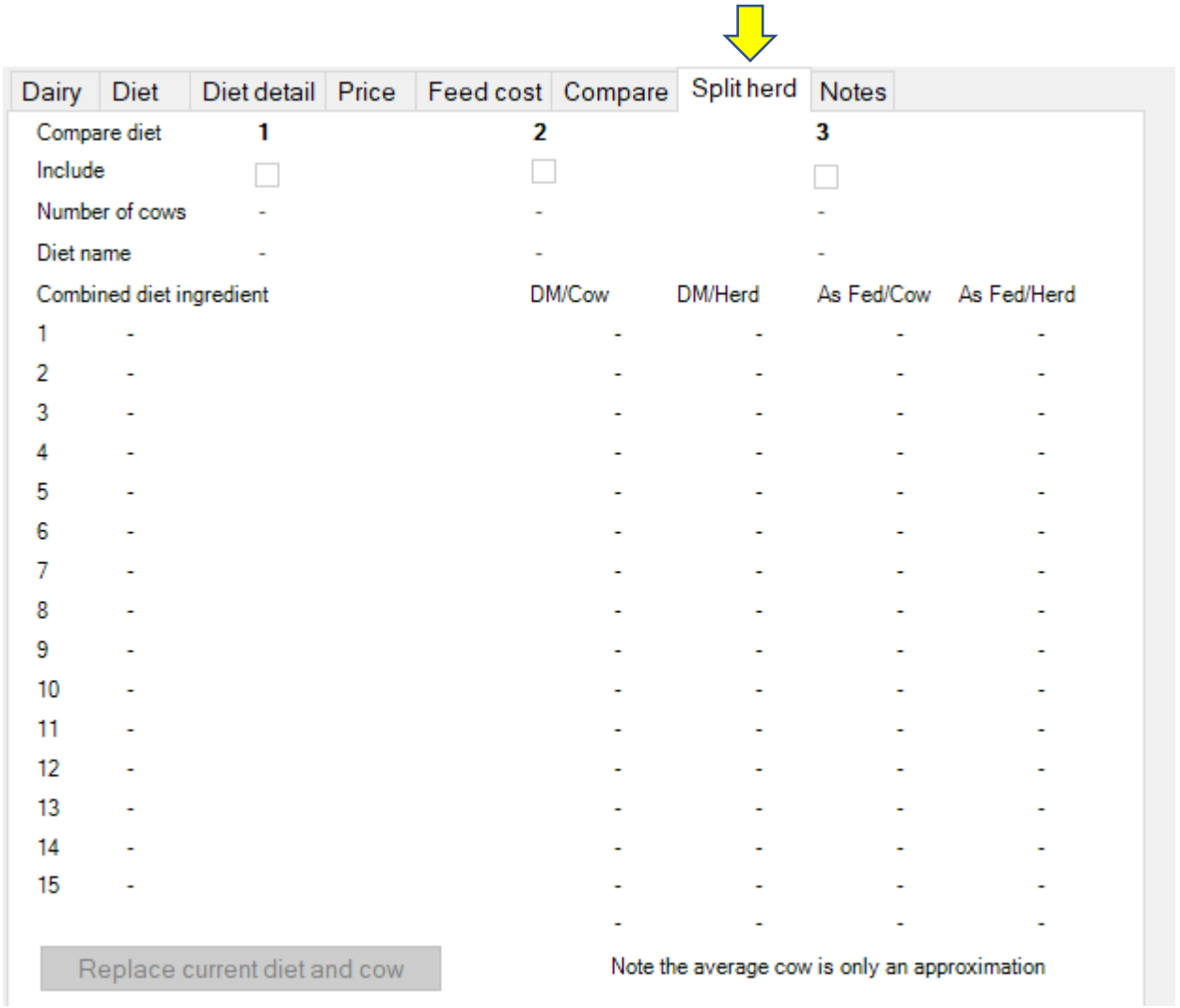
23. The ‘Compare’ tab

- The Compare tab is a feature where 3 diets can be stored. The parameters that are visible include; the quantities (as DM) of diet ingredients, percentage of optimal DMI (in the NDF method and NRC method), supply and demand of ME and MP and MAFC.
- This is a useful page to discuss with the farmer. Ask the farmer choose the best diet for his farm.
- With the S(store) button, the diet is saved in slots 1, 2, or 3. They can also be (R)restored or (C)cleared.



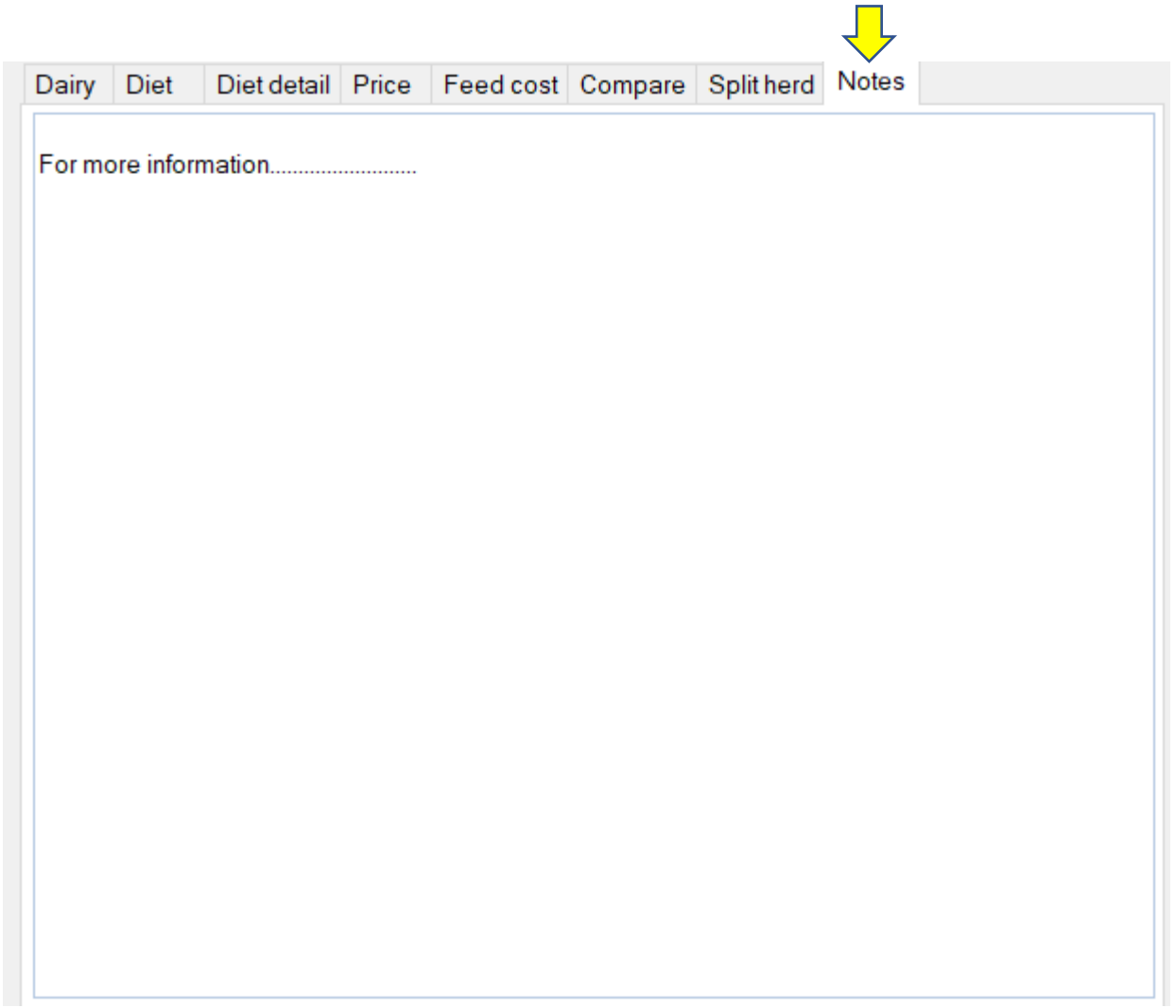
24. The ‘Split-herd’ tab

- Spilt herd is where you apply the rations for the whole herd.
- You can fill in the number of cows on your farm to calculate the number of feeds you will need to make the ration for the whole herd.
- Sometimes, a tab ‘Split herd’ is shown to the right of the Compare tab. This facility is rarely used in the tropics and we recommend to un-tick it under <File>, <Preferences>, <General> so it is no longer visible.



25. The ‘Notes’ tab

- This is where you can type anything you like relating to the ration, ingredients, the cow and more.
- It is useful for indicating different background notes of all these, plus what you think the ration can achieve and many more.
- The notes can be used as a reference after a long time.
- It is also useful when you want to share the ration with your peers or nutritionist, extra information could be useful or you exchange notes about the ration.

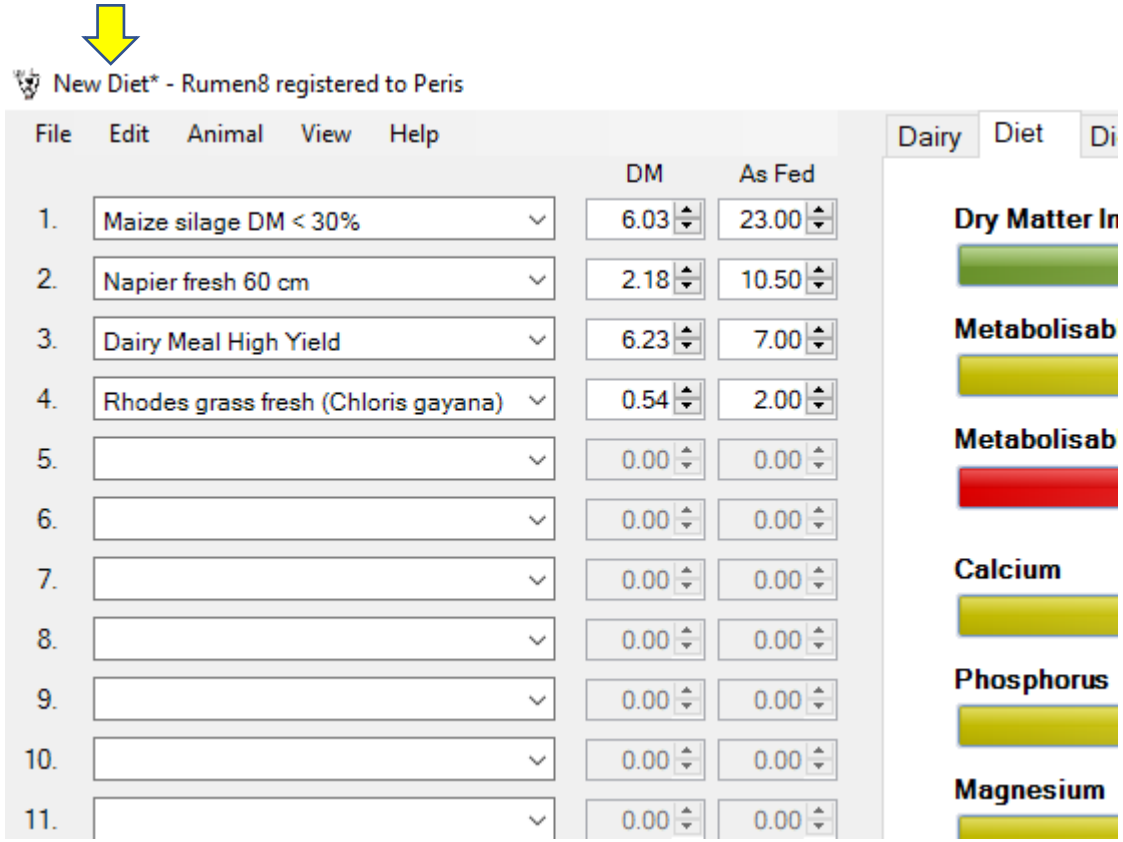


26. Saving a ration

- On the top right of the screen is the name of the ration.
- If the ration is new, it has the default name ‘Save Diet’ that tells you the ration is not saved.
- In case you make changes to an existing ration, it will inform you to save changes.
- Next to ‘New Diet’ the software informs you whom it is registered to.

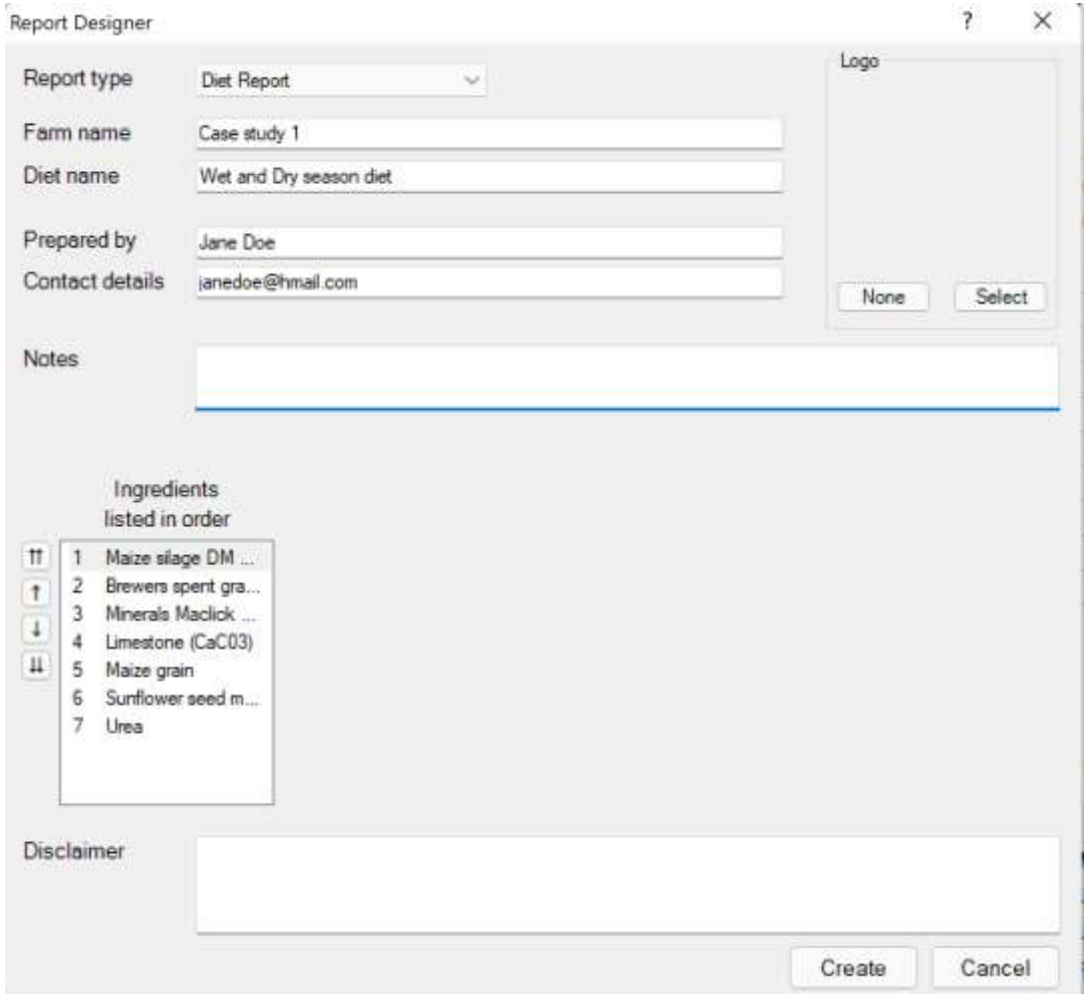
Further reference:

- See topic: **‘3.10. Use of Rumen8 software for ration calculation’** for an example of a ration.



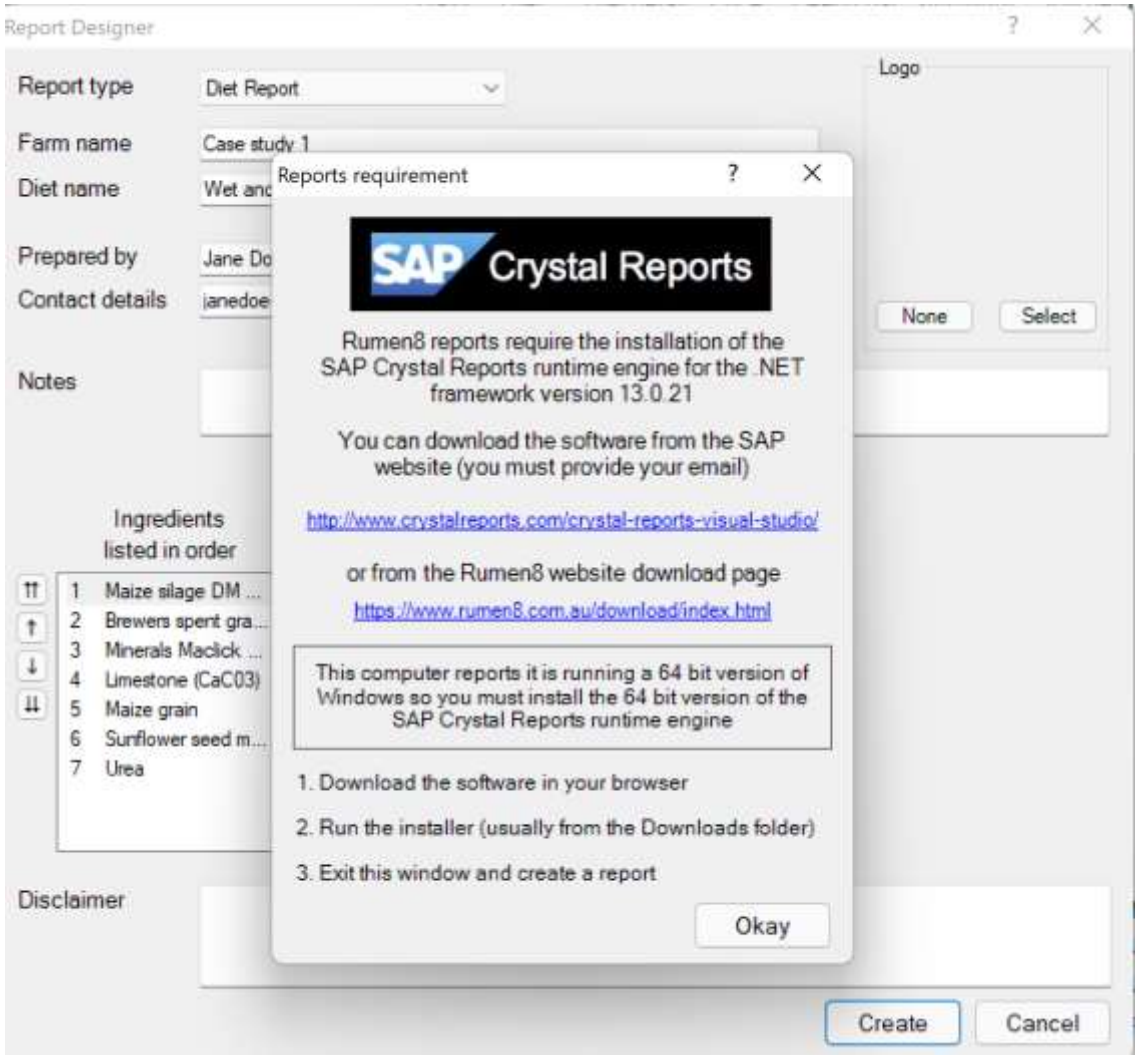
27. Share PDF report

- To print or share a PDF report, click the tab ‘File’, then click option ‘Report’.
- Firstly, select the diet report from the options in the ‘Report type’. Selecting this will create a report for one ration that is recently opened under the landing page.
- To create a report for the ration saved under the ‘Compare’ select option ‘Diet comparison report’ and all the ration will be captured.
- After this fill in the other details as shown and click ‘create’ to create a PDF report. You can add notes or disclaimers to your report (optional).



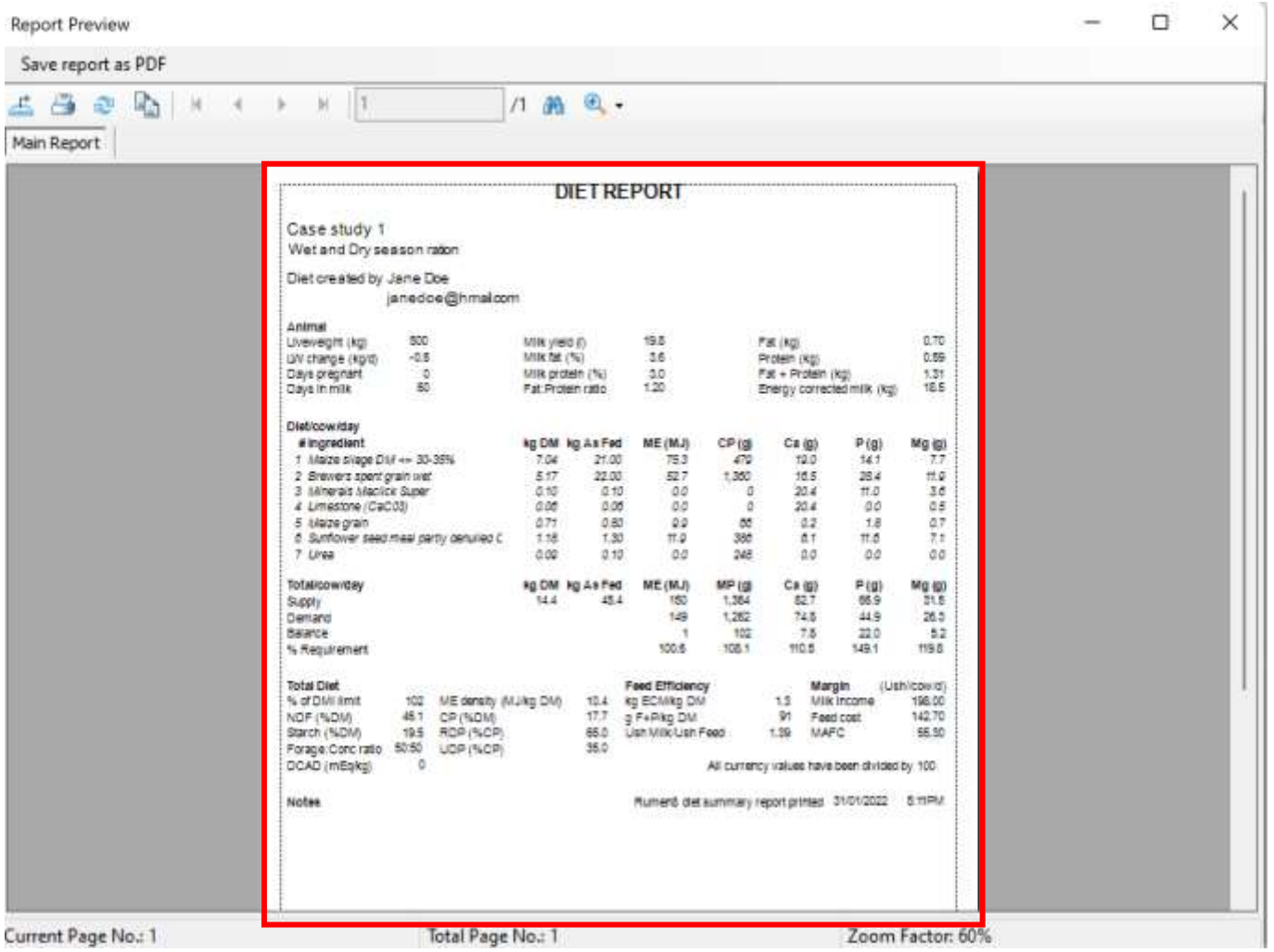
28. Requirement for PDF report saving and printing.

- After clicking ‘Create’, a report requirement pop-ups with links to guide to download a report creating software.
- Follow the link and guidelines with the installation and set up process.



28.1 PDF report document

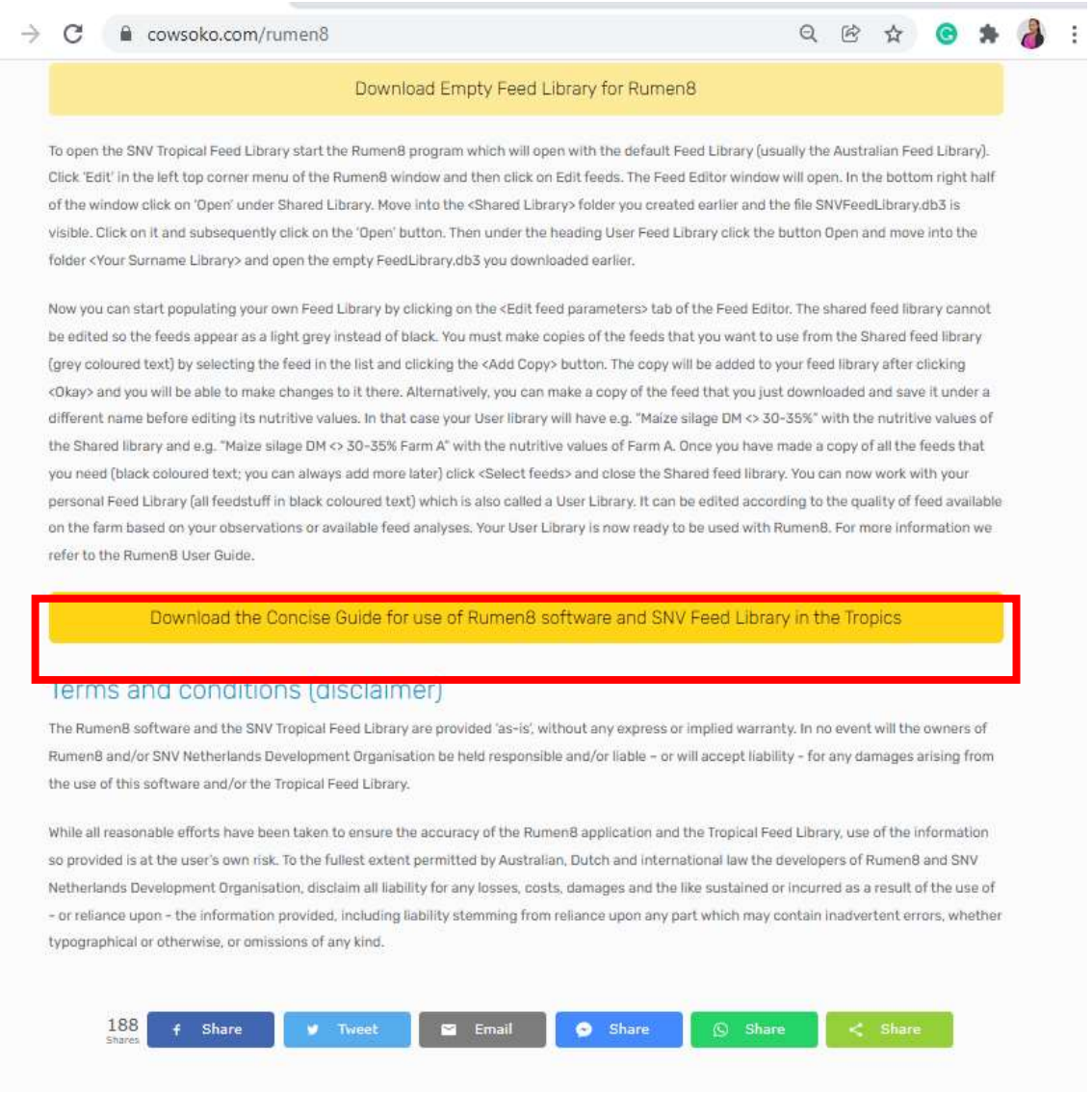
- After successful installation, go back to creating your report.
- A pop-up screen will appear with a report (red box). You can choose to save or print for sharing.
- A consultant should leave this report either hardcopy or softcopy for their clients to refer to during feeding.



29. More information on Rumen8

- More information about using Rumen8 can be found in the User Guide (Look in the Windows Start menu).
- When installing Rumen8, three supporting documents are placed in the Rumen8 group in the Start menu of your laptop. They are updated whenever Rumen8 is running/active.
- The Rumen8 User Guide is used most frequently and can also be accessed through the Help menu, the help button (?) in the top right of most Rumen8 windows (not the main window), or by pressing F1.
- The Rumen8 Training Manual is a good reference document too.

Watch video:
YouTube link: https://youtu.be/TG7zN7TEQ-Q



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