Theme 3: Animal Nutrition and Feeding

MONITORING FEEDING MANAGEMENT, USING KPIs (BASED ON 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):

- ❑ How to identify the key performance indicators (KPIs) in feeding dairy cows.
- ❑ The KPIs in Rumen8 and factors that affect them.

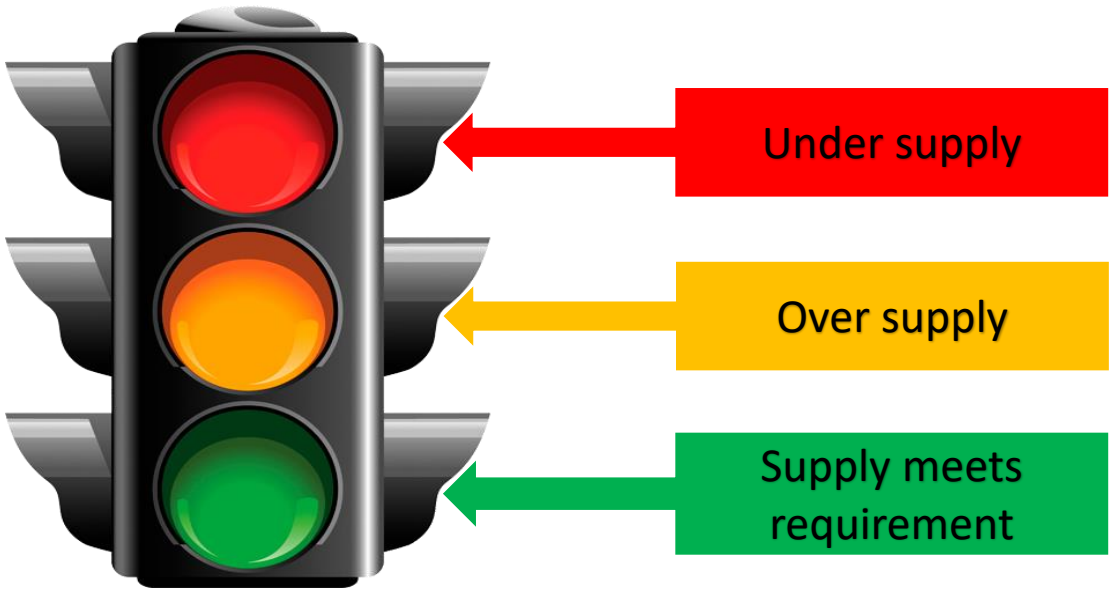
2. Background

- Rumen8 is a free access software application that allows farmers and livestock consultants to easily manage dairy, dual-purpose and beef cattle rations to optimize animal performance, reduce feed costs and maximize margin above feed costs.
- Rumen8 allows the user to design rations with guided parameters that aim at making healthy formulated ration.
- The modules below also explain more about Rumen8 and guide the user, by demonstrating examples of rations formulation process;
  i. 3.9.: Guidelines for ration calculations for various breeds, heifers, lactation stage (Rumen8)
  ii. 3.10.: Use of Rumen8 software for ration calculation.

* Screenshot of the opening page of the rumen8 software.

2.1 Background Cont'd…

- KPIs is an abbreviation of key performance indicators, which refer to a set of quantifiable measurements used to gauge overall performance.
- In some instances in Rumen8 software, color codes are used to represent performances; for example while making a ration;
    i. Red - Under supply,
    ii. Green - meets the requirement/demand,
    iii. Yellow - Oversupply/exceeds the animal requirement.
- There are several measures in Rumen8 software that guides the user in monitoring the feeding management of dairy cows.

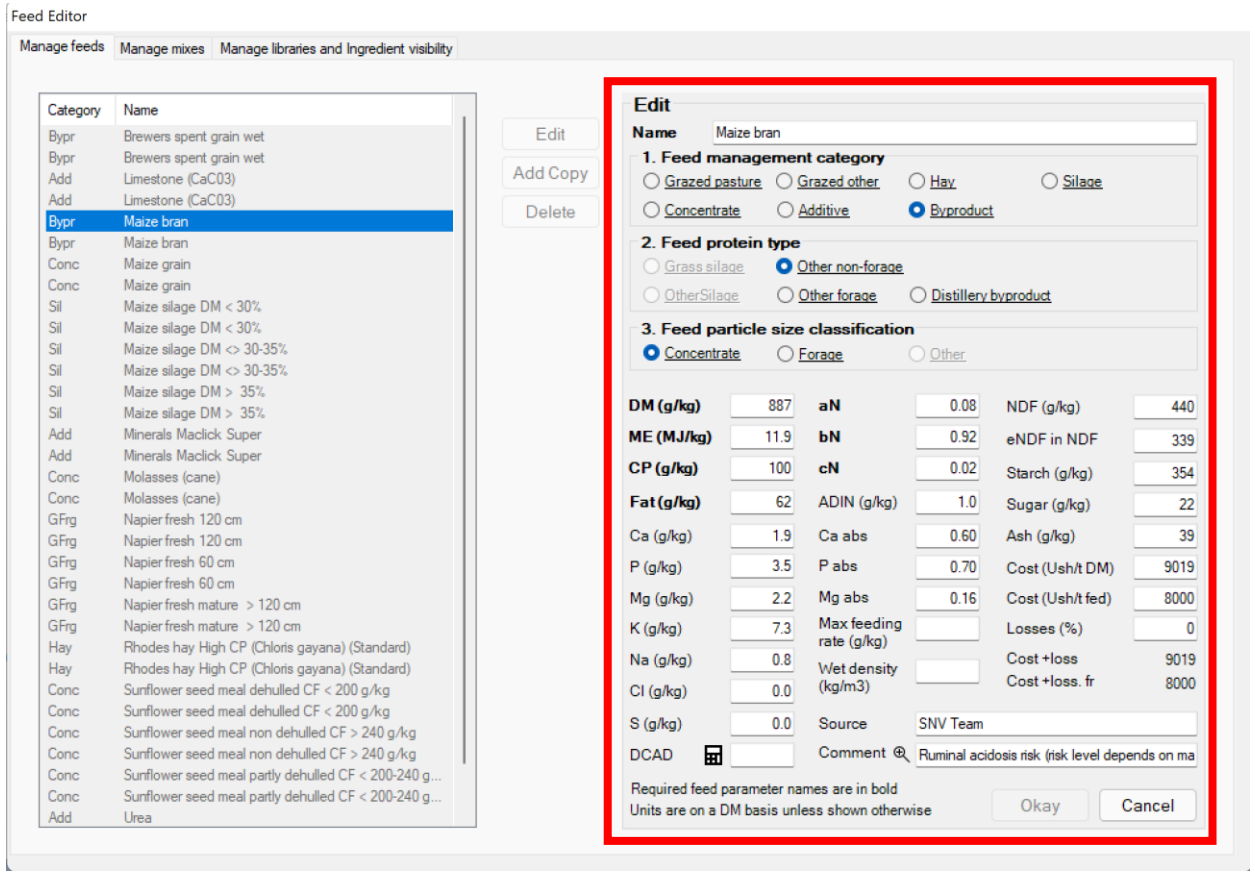


3. Rumen8 measures of performance

- Key performance indicators in Rumen8 can be divided into three categories;
  i. Feed ingredient KPIs
  ii. Ration KPIs
  iii. Feed cost KPIs

4. Feed ingredient KPIs

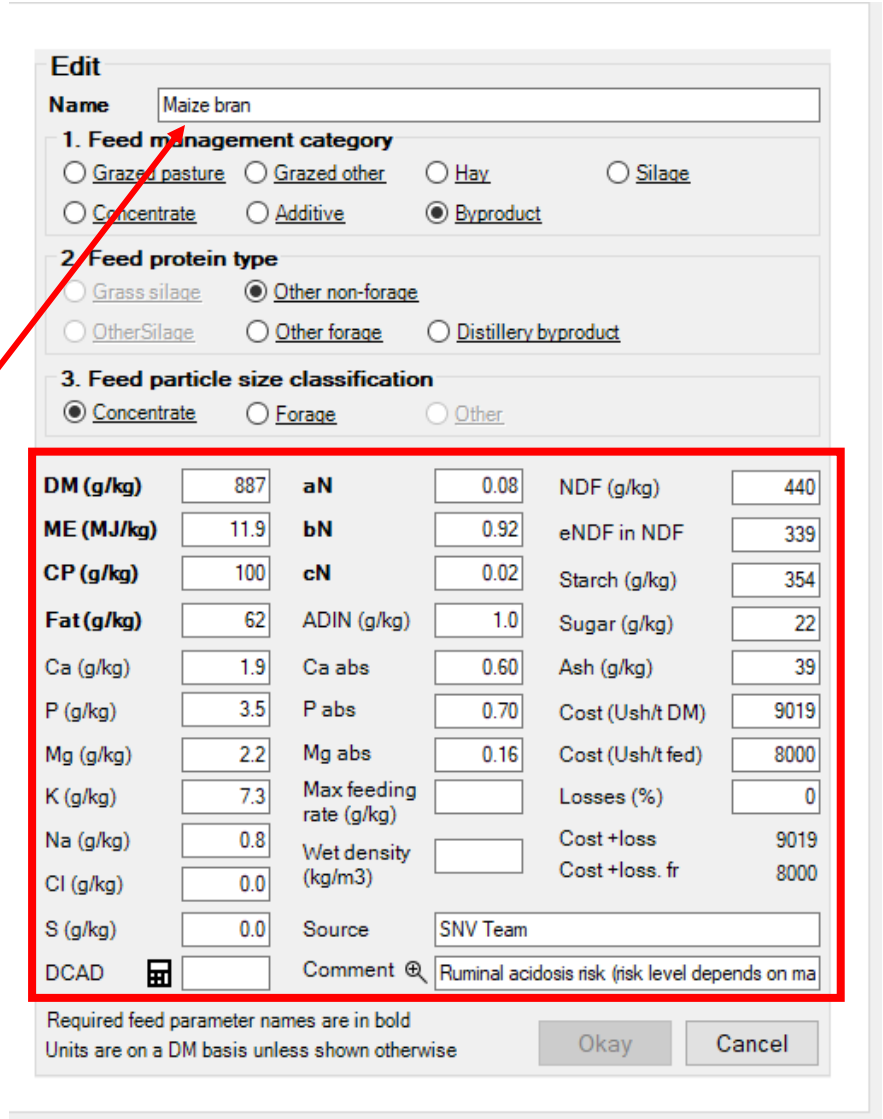
- The feed ingredient has measures of quality of the ingredient, that is populated after a feed analysis or estimated by an expert based on their experience and expertise.
- To do this or view the feed parameter in Rumen 8, follow the following steps;
  - Click on the tab ‘Edit’ on the Rumen8 landing page, then click the option ‘Edit Feeds’. A pop-up screen will appear with several tabs, select the tab ‘Manage feeds’ the display will appear as shown on the picture.
  - On the right-hand side after selecting a feed ingredient the parameters of quality are displayed (Red box).



4.1 Feed ingredient parameters

- The feed ingredients' measure of quality is expressed in the following parameters (red box);
  - DM - Dry matter of the feed (g/kg as fed)
  - ME - Metabolizable energy (MJ/Kg DM)
  - CP - Crude protein (g/kg DM)
  - Fat - (g/kg DM)
  - NDF - Neutral detergent fiber(g/kg DM)
  - Starch - (g/kg DM)
  - Sugar - (g/kg DM)
  - Ash contents - (g/kg DM)

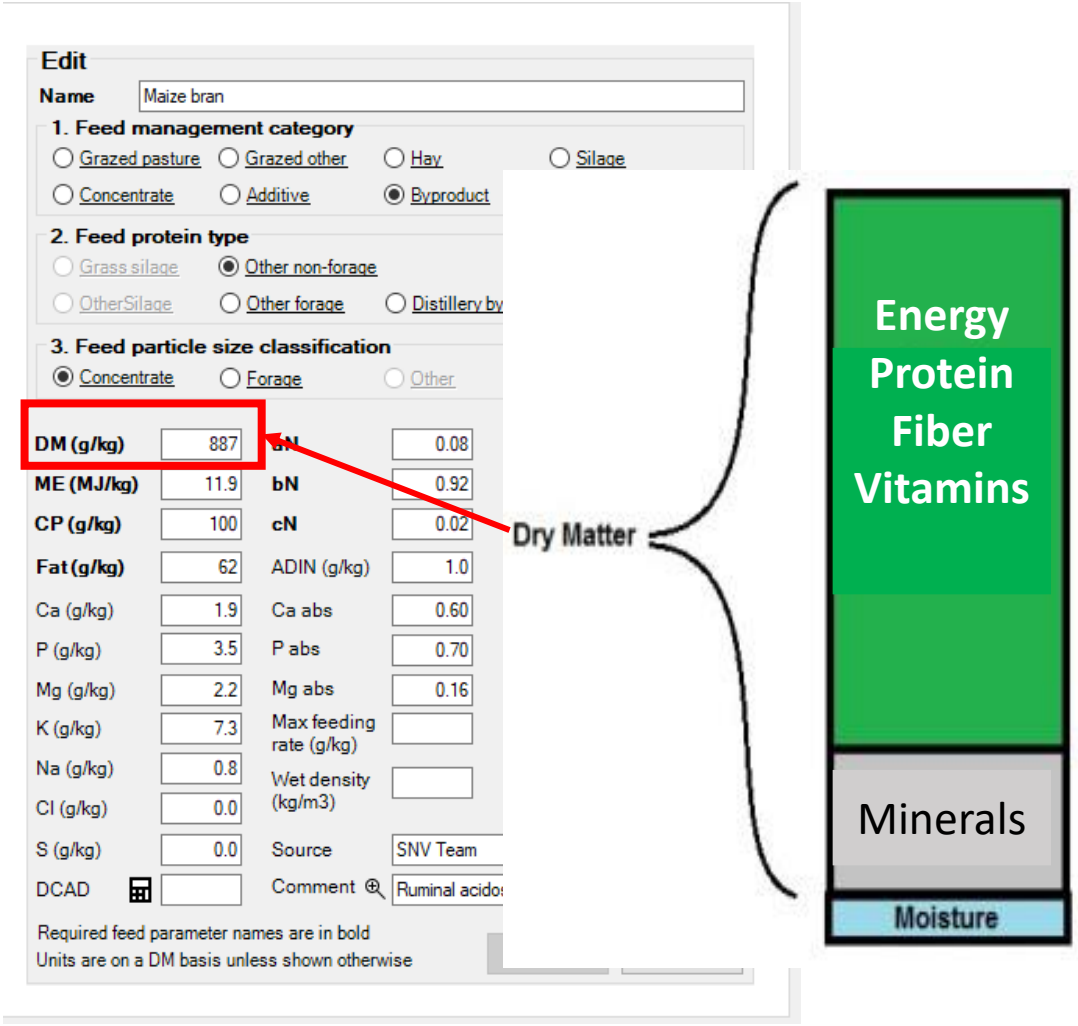
- We will select Maize bran and view its parameters as an example.



4.2 Dry matter composition of a feed ingredient

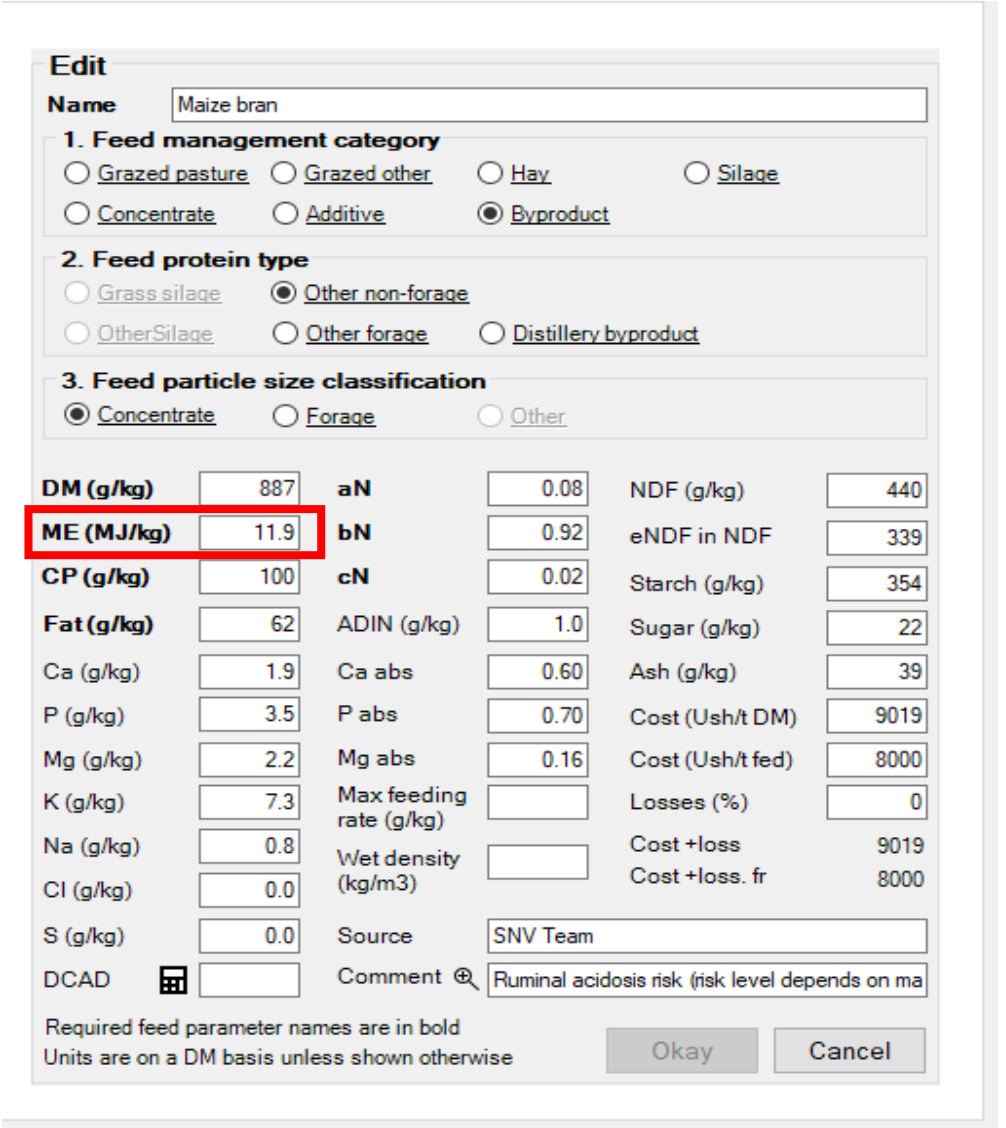
- The Dry matter represents everything contained in the feed sample except water/moisture.
- For this example, maize bran contains some moisture and the dry matter content in a kilogram of the feed is 0.887kg or 887gms (red box). Therefore, moisture content is 1kg-0.887kg=0.113kg.
- The nutritive value of feeds and fodder is found in this dry matter part. The dry matter composition contains;
  - ME - Metabolizable energy (MJ/Kg DM)
  - CP - Crude protein (g/kg DM)
  - Fat - (g/kg DM)
  - NDF - Neutral detergent fiber(g/kg DM)
  - Starch - (g/kg DM)
  - Sugar - (g/kg DM)
  - Ash contents - (g/kg DM)

Further reference: Estimating DMI for various breeds/age categories



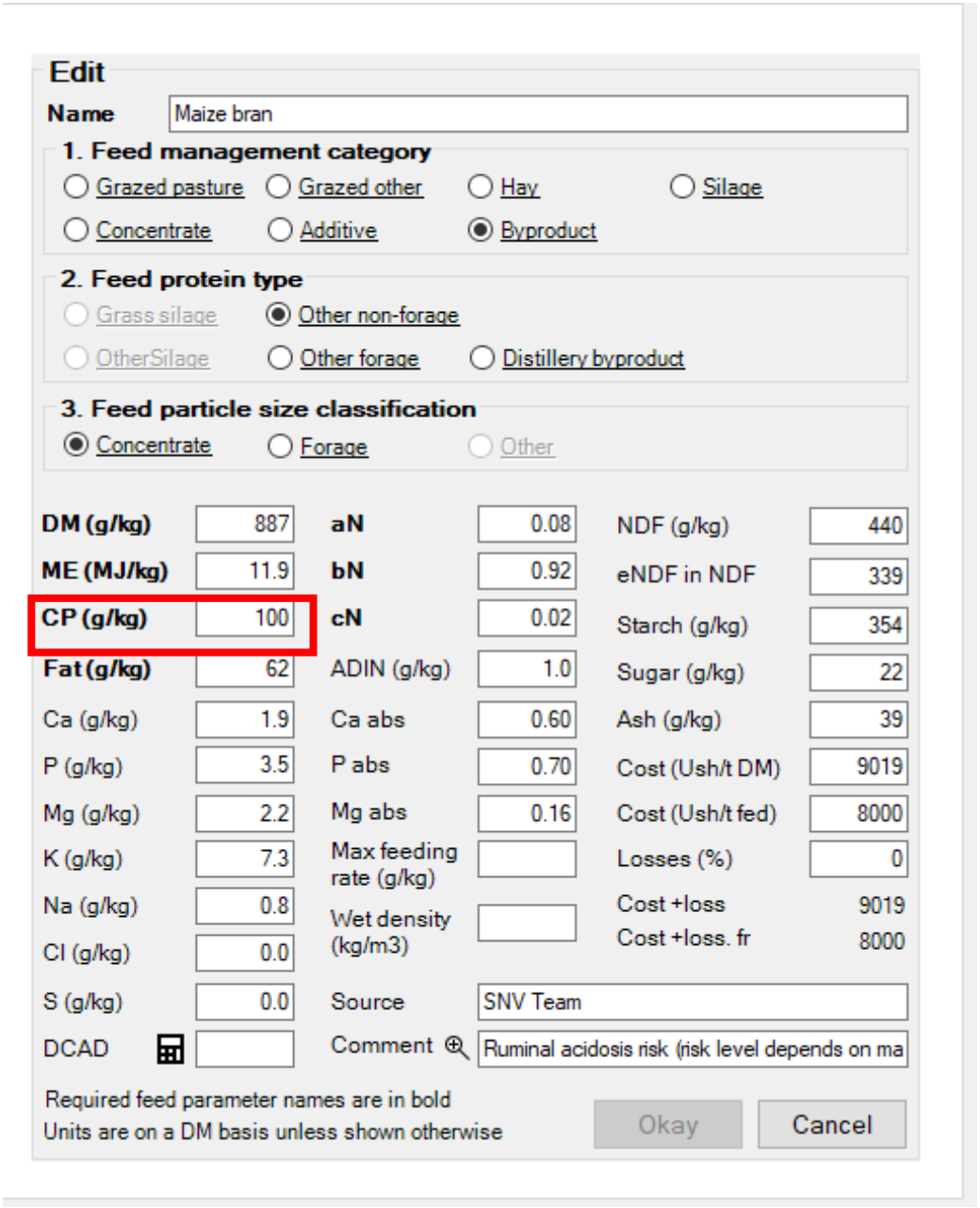
4.3 Metabolizable Energy of a feed ingredient

- The metabolizable energy (ME) is the amount of energy available from a feed once energy from faces, urine and gases has been subtracted.
- Essentially, ME is energy left for your cow's body to use once all digestion is complete.
- For maize bran, in one kilogram (1kg) of dry matter, ME is estimated at 11.9 Mega joules (MJ).
- Forages generally have a low supply of ME while concentrates generally have higher ME.



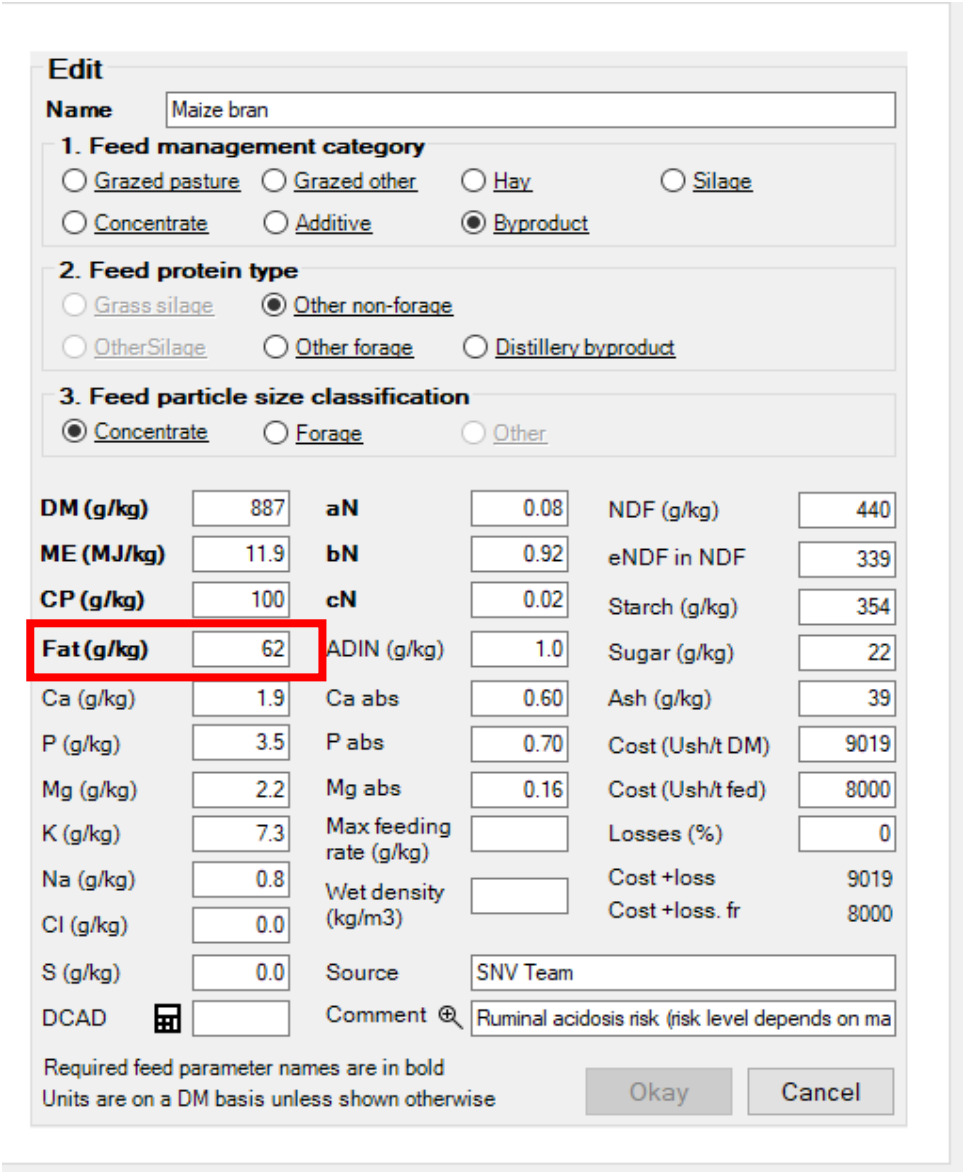
4.4 Crude Protein of a feed ingredient

- The crude protein (CP) content of a feed sample represents the total nitrogen (N) in the ration, which includes only true protein but also non-protein nitrogen e.g. Urea.
- For maize bran, in one kilogram (1kg) of dry matter, CP is estimated to be 0.1kg which is 100g (red box).
- Some feeds are considered to be good suppliers of CP and others are low. In most cases, concentrates have a better supply of CP.
- During ration calculation, a user should consider a feed ingredient that can supply both ME and CP at a low cost.



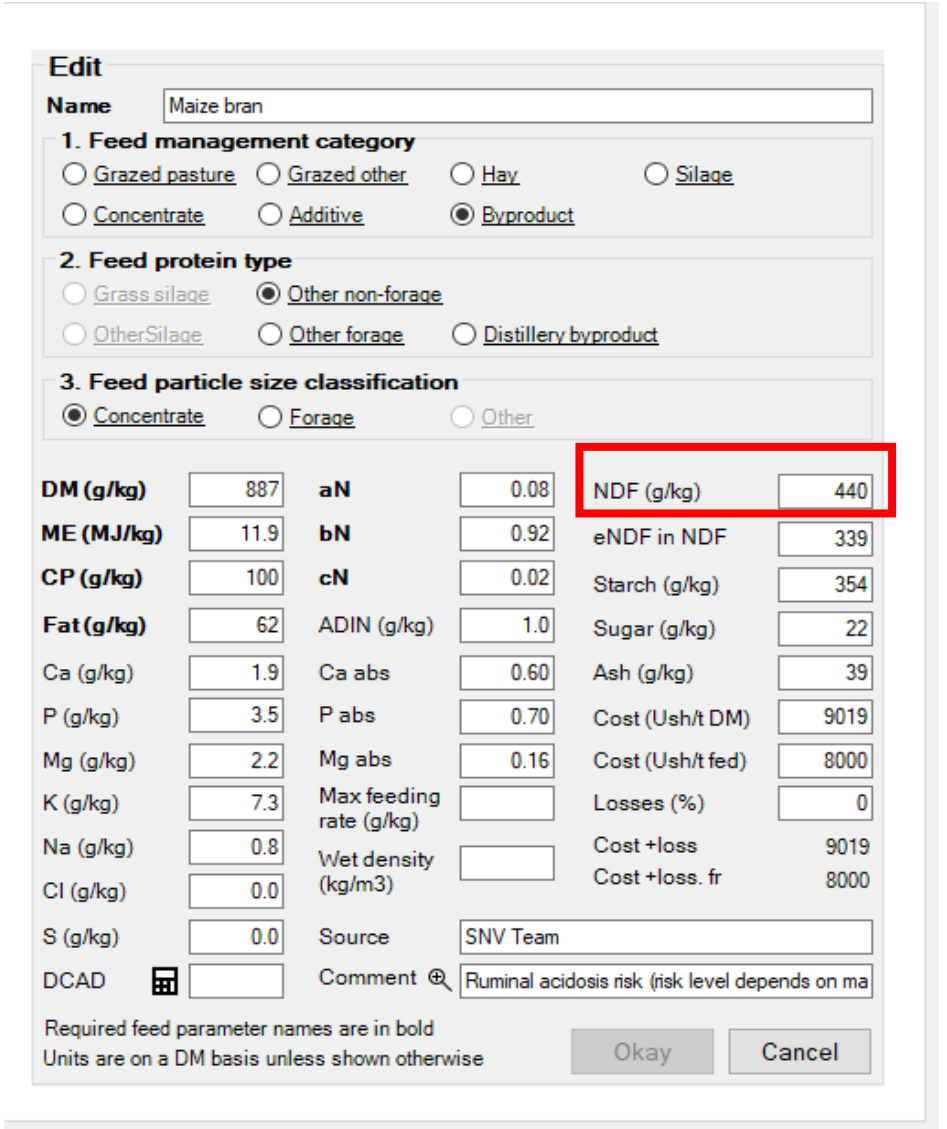
4.5 Fat quantity of a feed ingredient

- Fats are rich in energy and can be used to supply energy and contains 2.25 to 2.8 times the energy found in carbohydrates and are highly digestible.
- Fat is added to rations to boost energy levels when intake may be limited due to poor animals health, less palatable feed or environmental stress.
- For maize bran, in one kilogram (1kg) of dry matter, fat content is 0.062kg which is 62g (red box).



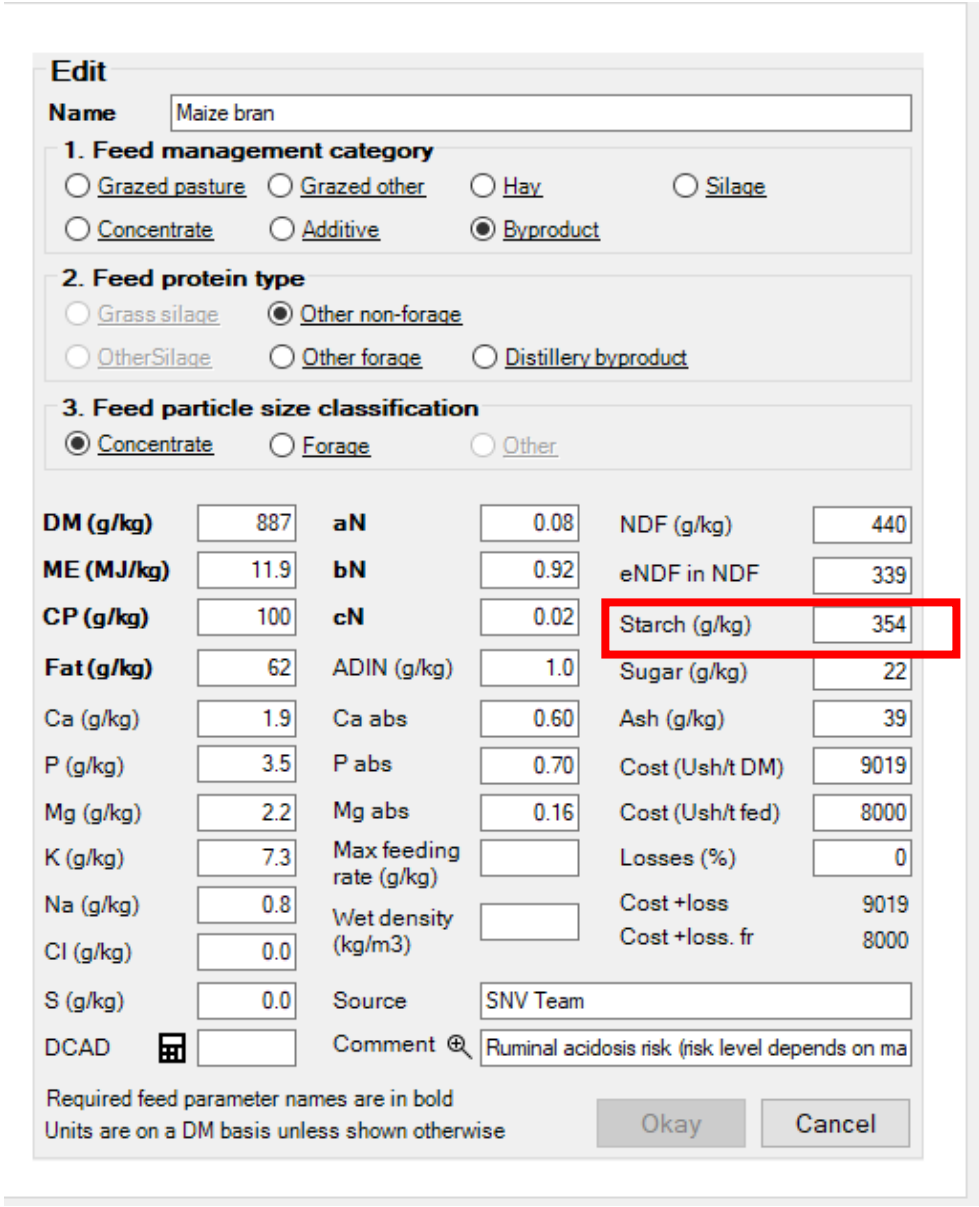
4.6 Neutral Detergent Fibre of a feed ingredient

- The neutral detergent fiber (NDF) is the fiber content in the dry matter.
- For maize bran, in one kilogram (1kg) of dry matter, NDF content is 0.44kg which is 440g (red box) i.e. in the percentage of dry matter is 440/1000 X 100%= 44%.



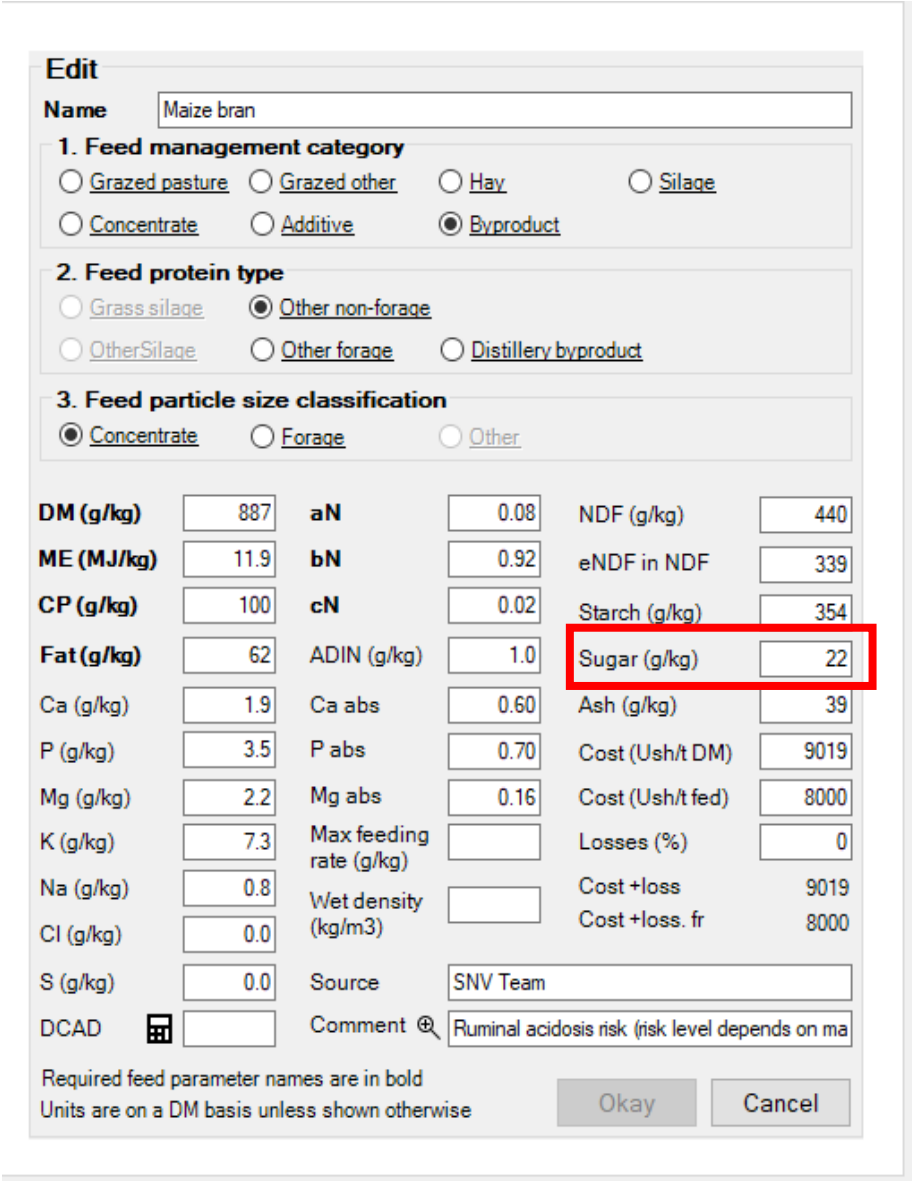
4.7 Starch content of a feed ingredient

- This is readily available as a source of energy.
- For maize bran, in one kilogram (1kg) of dry matter, starch content is 0.354kg which is 354g (red box) i.e 35.4% of the dry matter of maize bran.



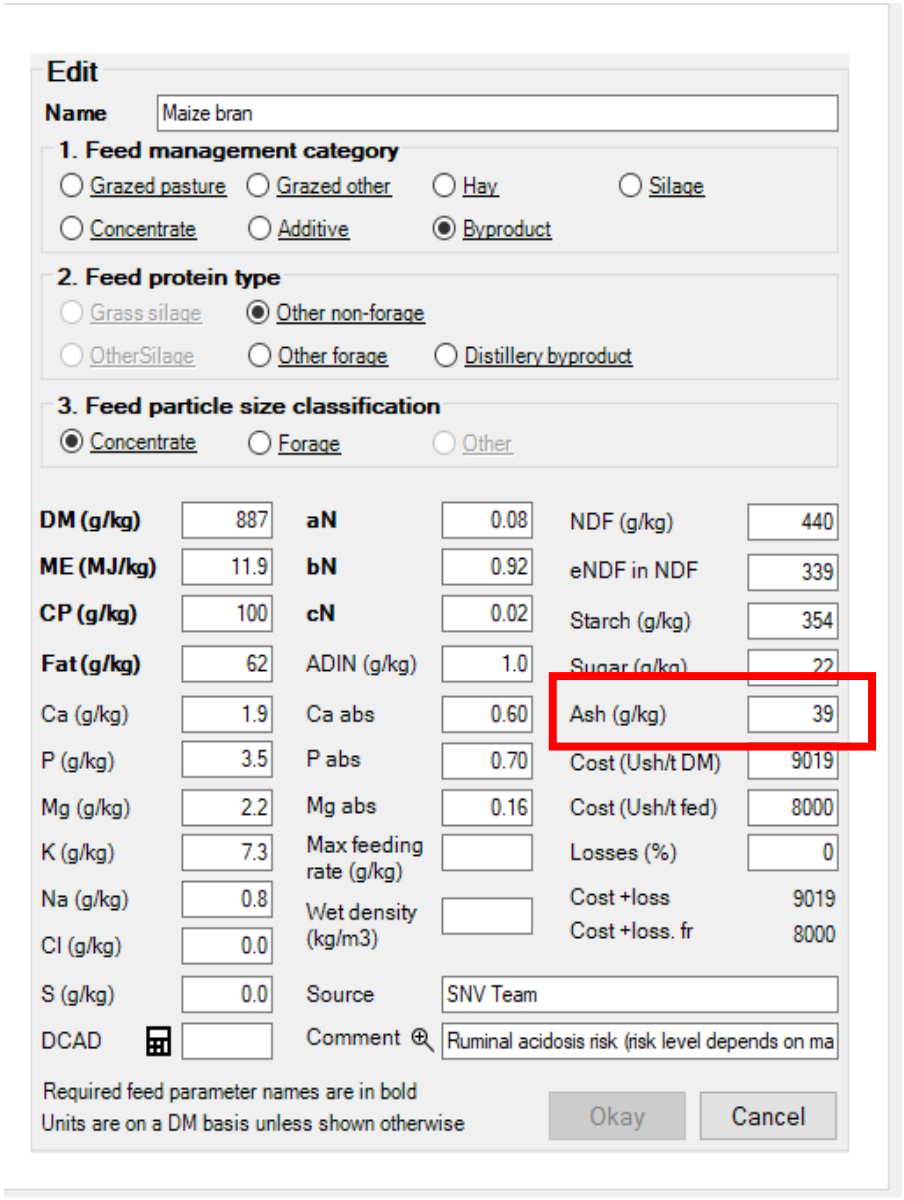
4.8 Sugar content of a feed ingredient

- Sugar is a natural component of the diet of dairy cows. The sugars consumed have been from pasture and hay, which are naturally high in sugars.
- For maize bran, in one kilogram (1kg) of dry matter, sugar content is 0.022kg which is 22g (red box).



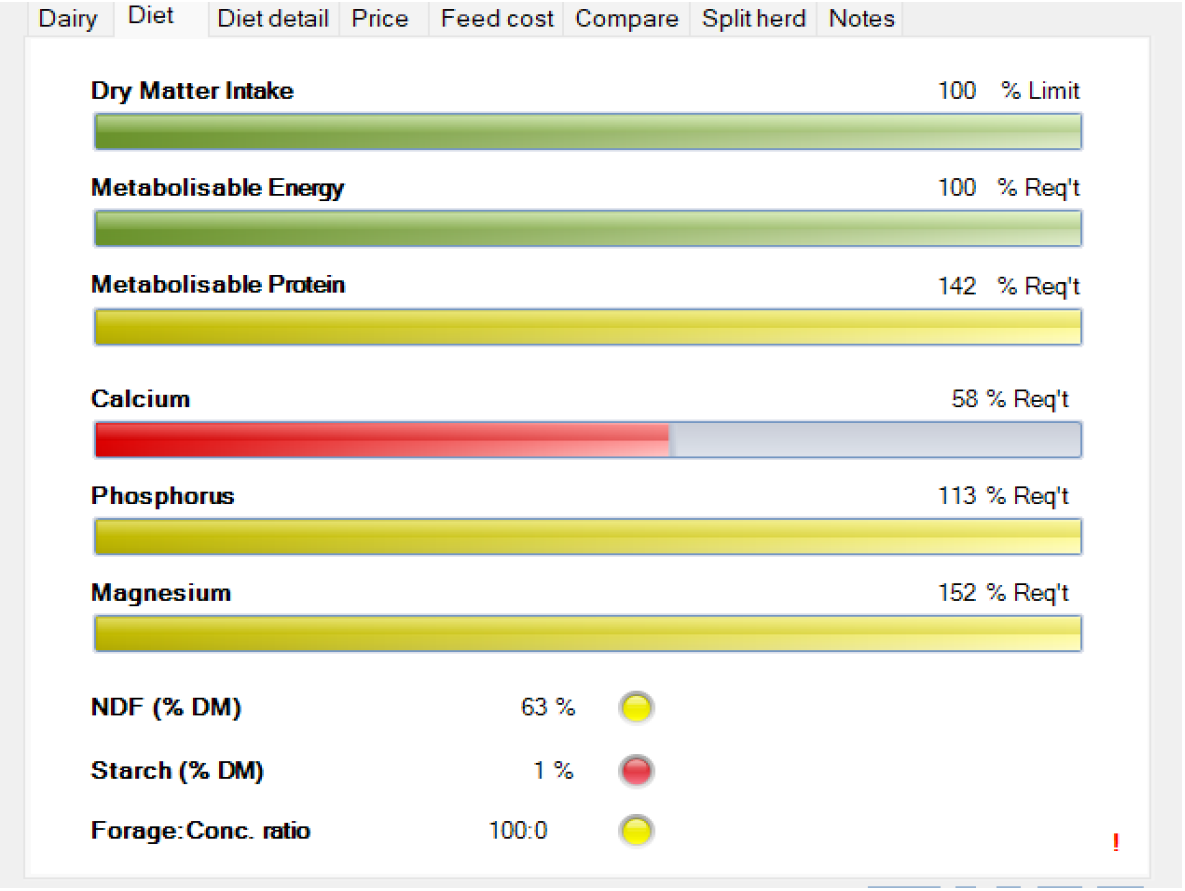
4.9 Ash content of a feed ingredient

- Ash is the residue containing inorganic minerals elements of a fed sample, determined in a laboratory.
- For maize bran, in one kilogram (1kg) of dry matter, ash content is 0.039kg which is 39g (red box).



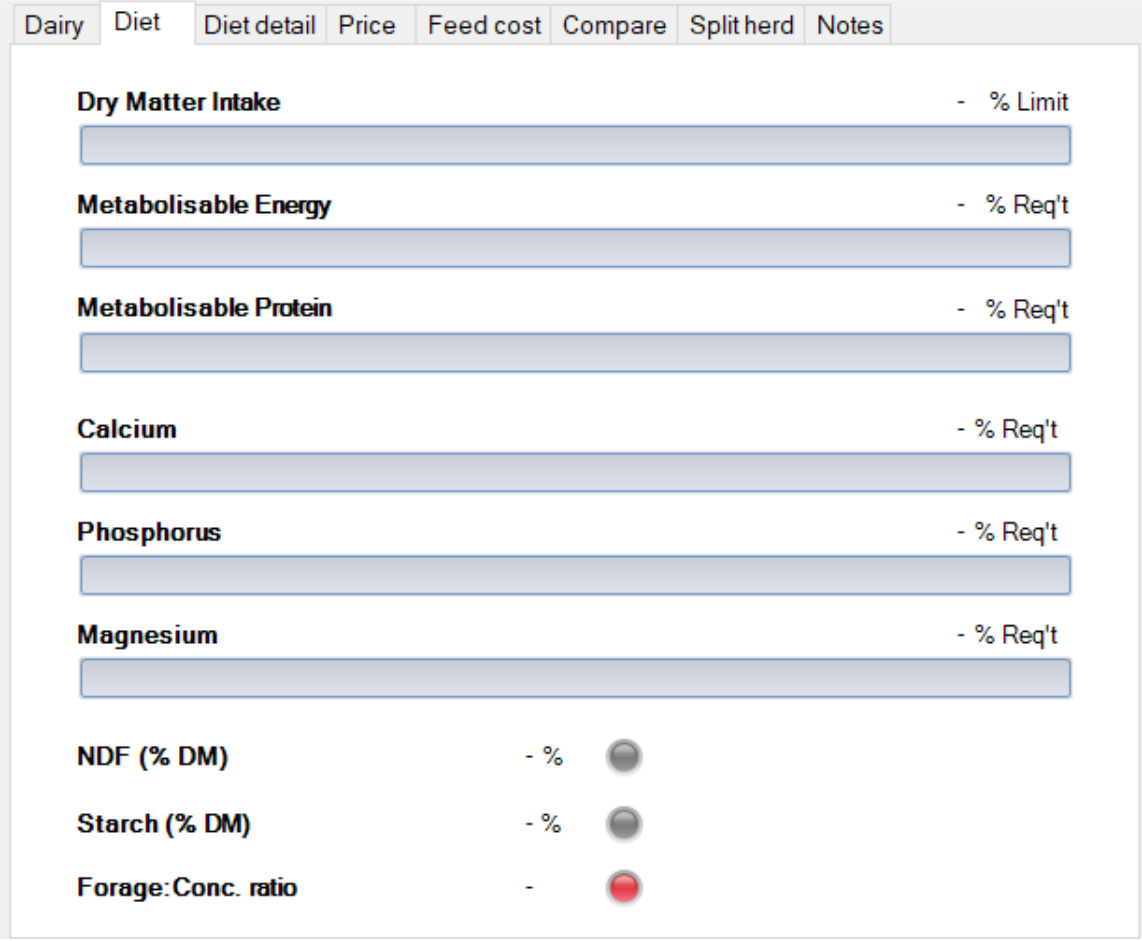
5. Ration formulation KPIs

- The ‘Diet’ tab will show how the ration matches the animal’s requirement i.e. how good is the ration to meet the cow’s requirements.
- 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 ration meets the requirement of the animal and will turn yellow if the ration 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.



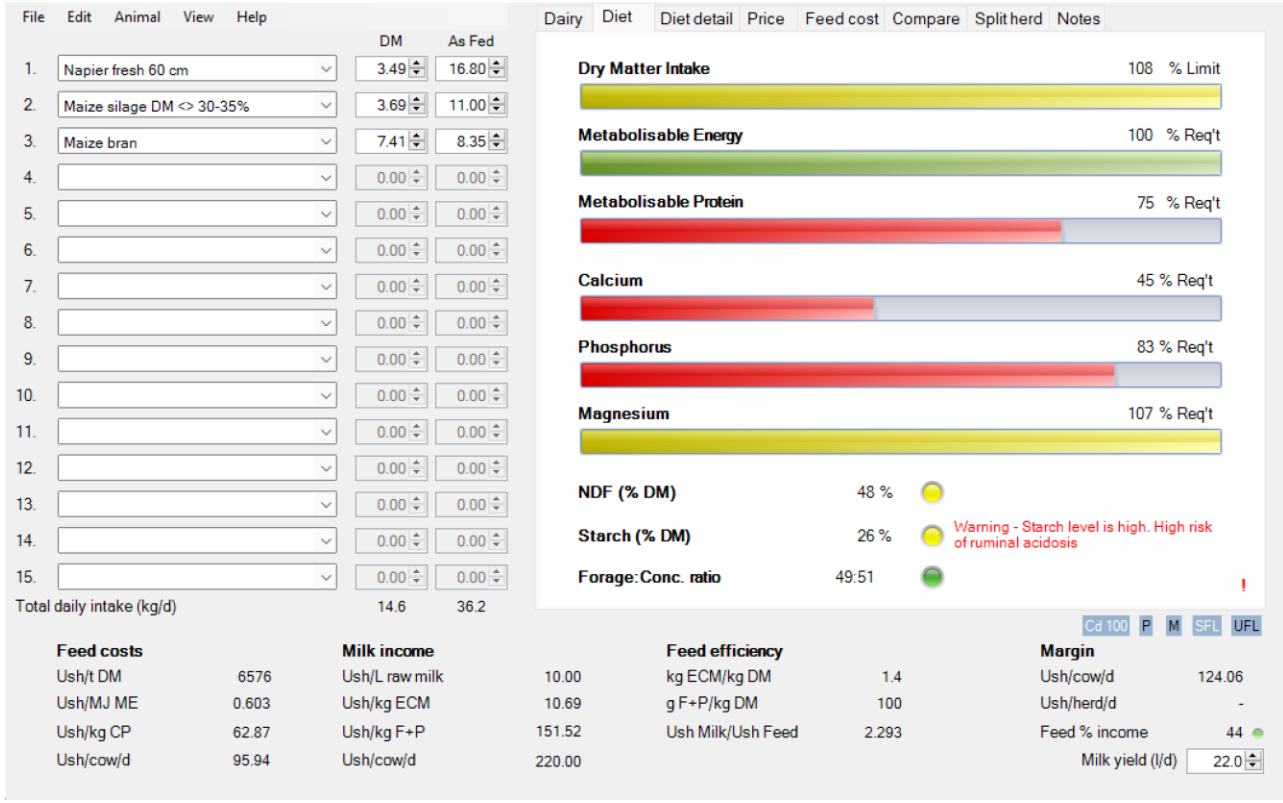
5.1 Ration formulation KPIs Cont'd…

- The measure of the ration meeting the requirement of the animal are displayed using the percentage of supply against demand, these are;
  - Dry matter intake
  - Metabolizable energy
  - Metabolizable protein
  - Minerals; Calcium, Phosphorus & Magnesium
  - NDF (%DM)
  - Starch (%DM)
  - Forage : Concentrate ratio



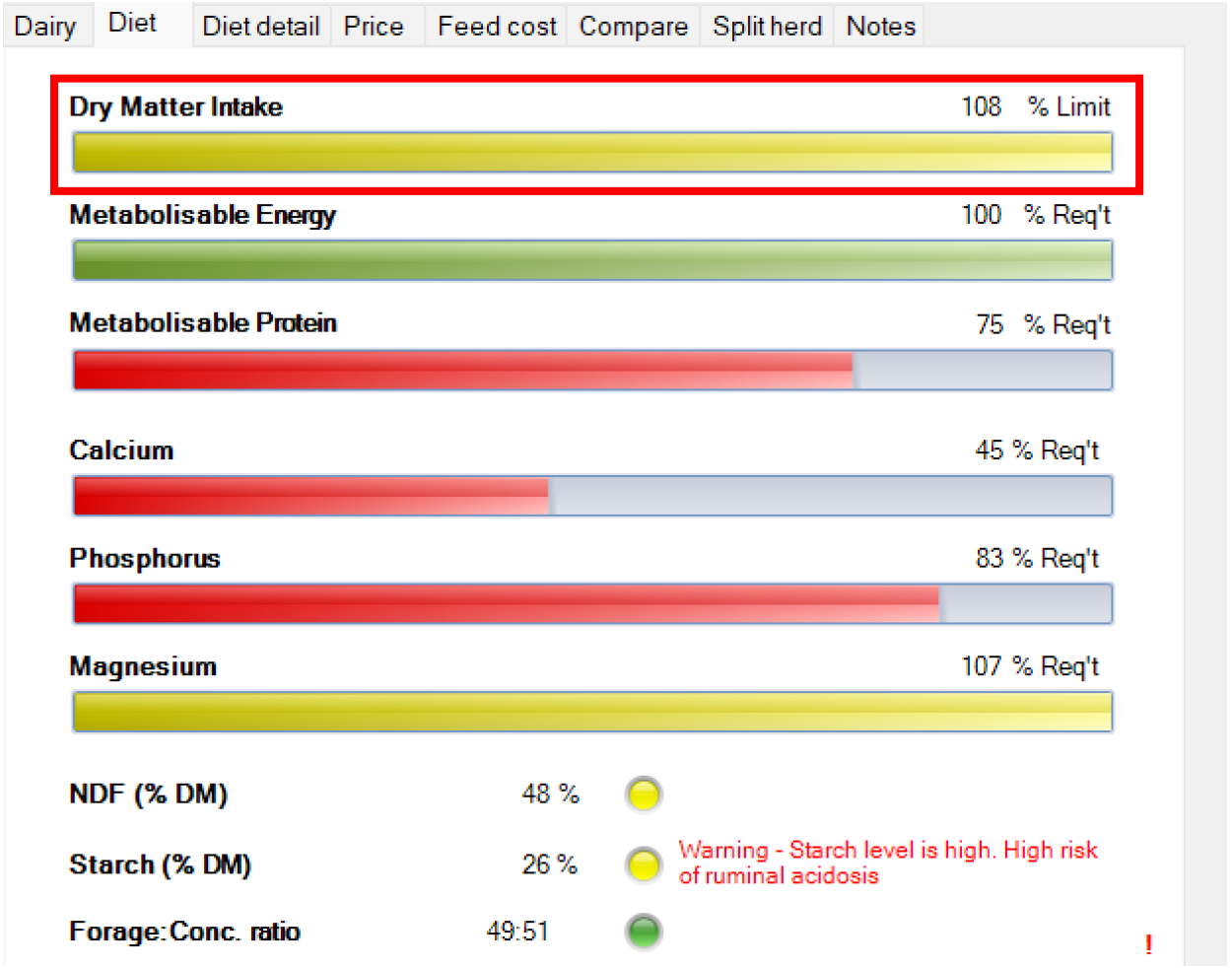
6. Ration calculation Indicators

- 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;
  i. Red - Under supply,
  ii. Green - meets the requirement/demand,
  iii. Yellow - Oversupply/exceeds the animal requirement.



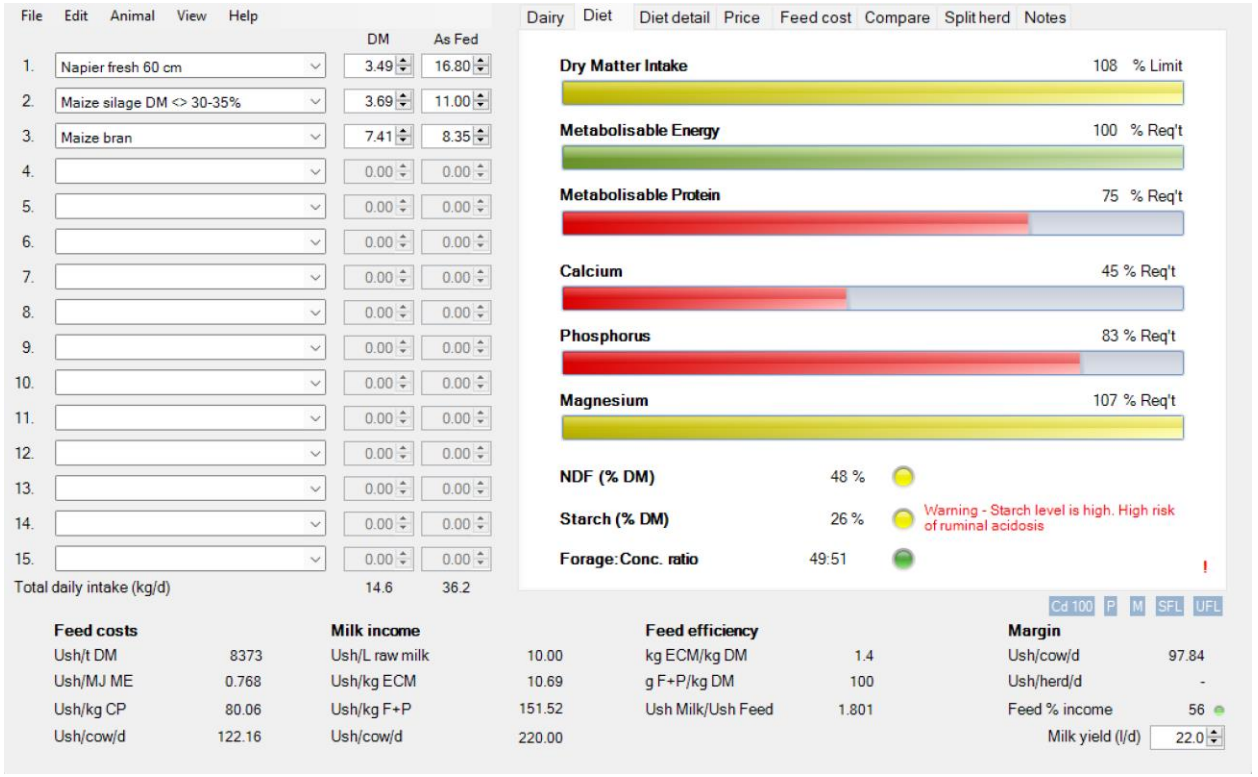
6.1 Ration Calculation Cont'd: Dry Matter Intake

- The dry matter intake is an estimate of the amount of dry matter a cow can eat per day. The bar represents the capacity of the cow.
- 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% it is unlikely the cow will be able to finish the ration.



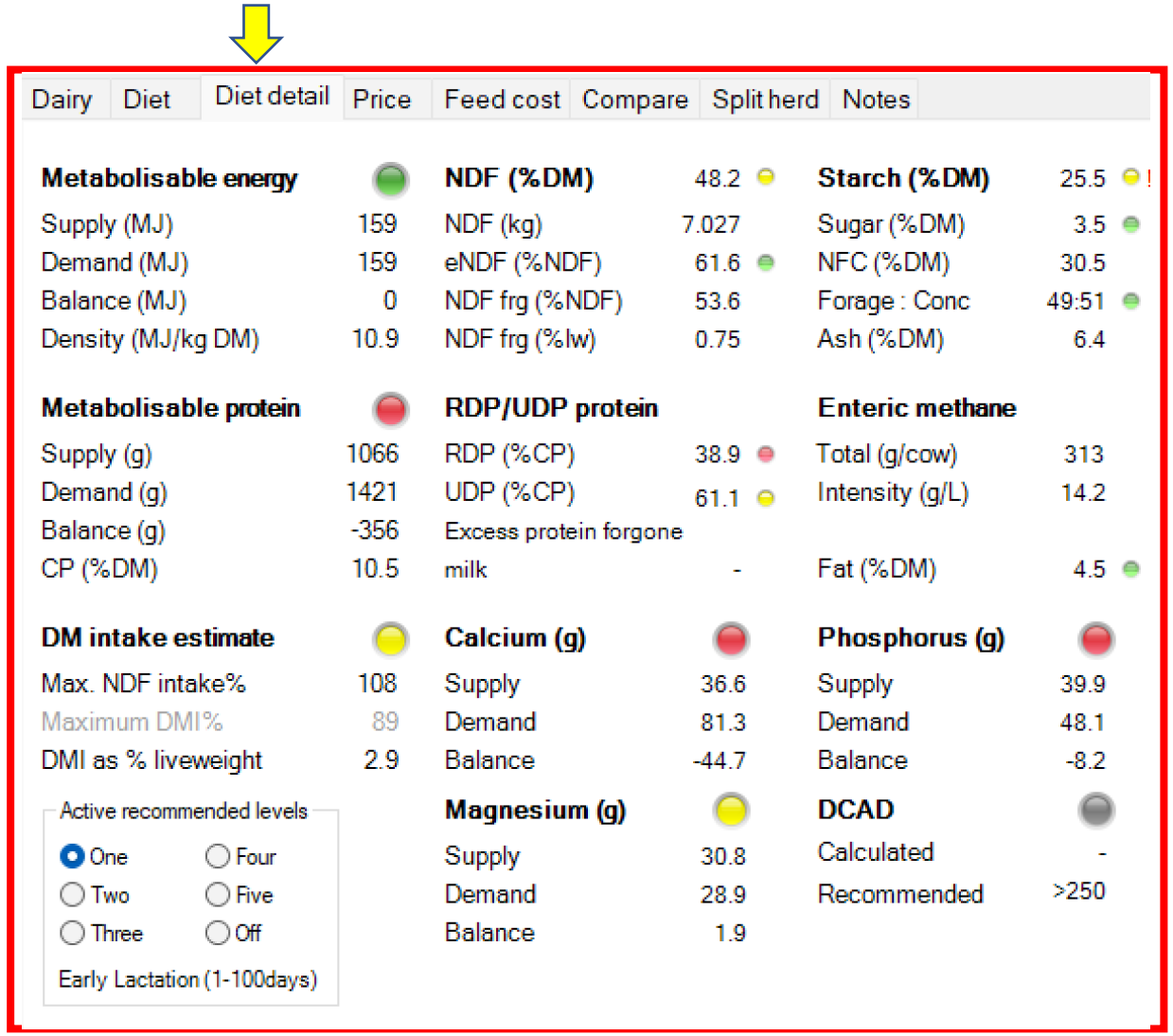
6.2 Ration calculation indicators Cont'd…

- 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 ration.
- However, Rumen8 does not generate money neither does it know the nutritional quality of the feeds available on the farm. It is up to the user to enter accurate and reliable data on the nutritional quality of the feed ingredients.



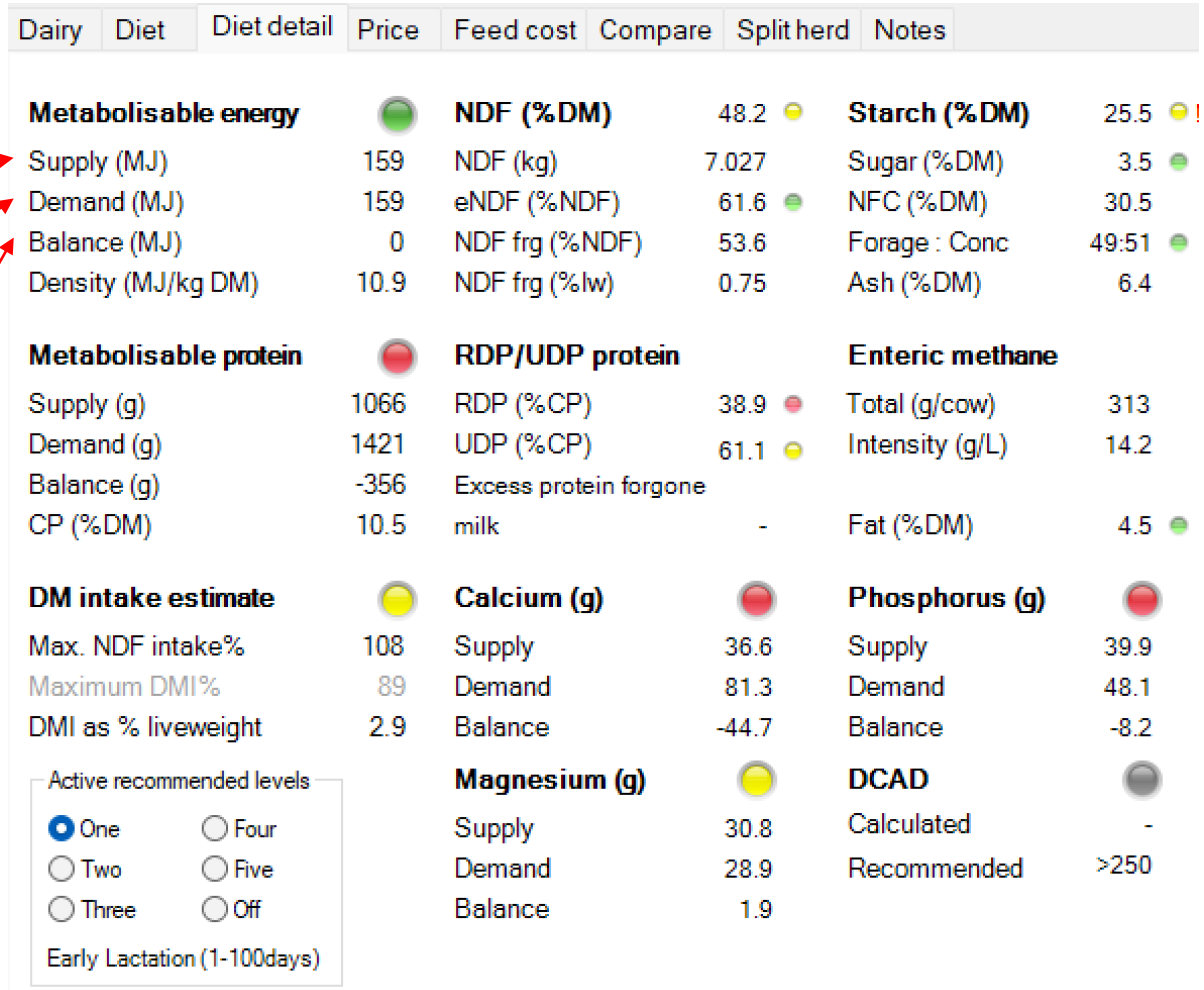
6.3 The ‘Diet detail’ tab

- The ‘Diet’ tab gives a good visual indication of how well the ration meets the individual cow requirements, but it is a summarized overview.
- The ‘Diet Detail’ tab gives the specifications of the ration in greater detail.
- The tab indicates supply against demand which can be expressed in different units such as Mega joules (MJ), density(MJ/Kg DM) grams (g) and percentages (%).
- The color code here indicates the rations status.



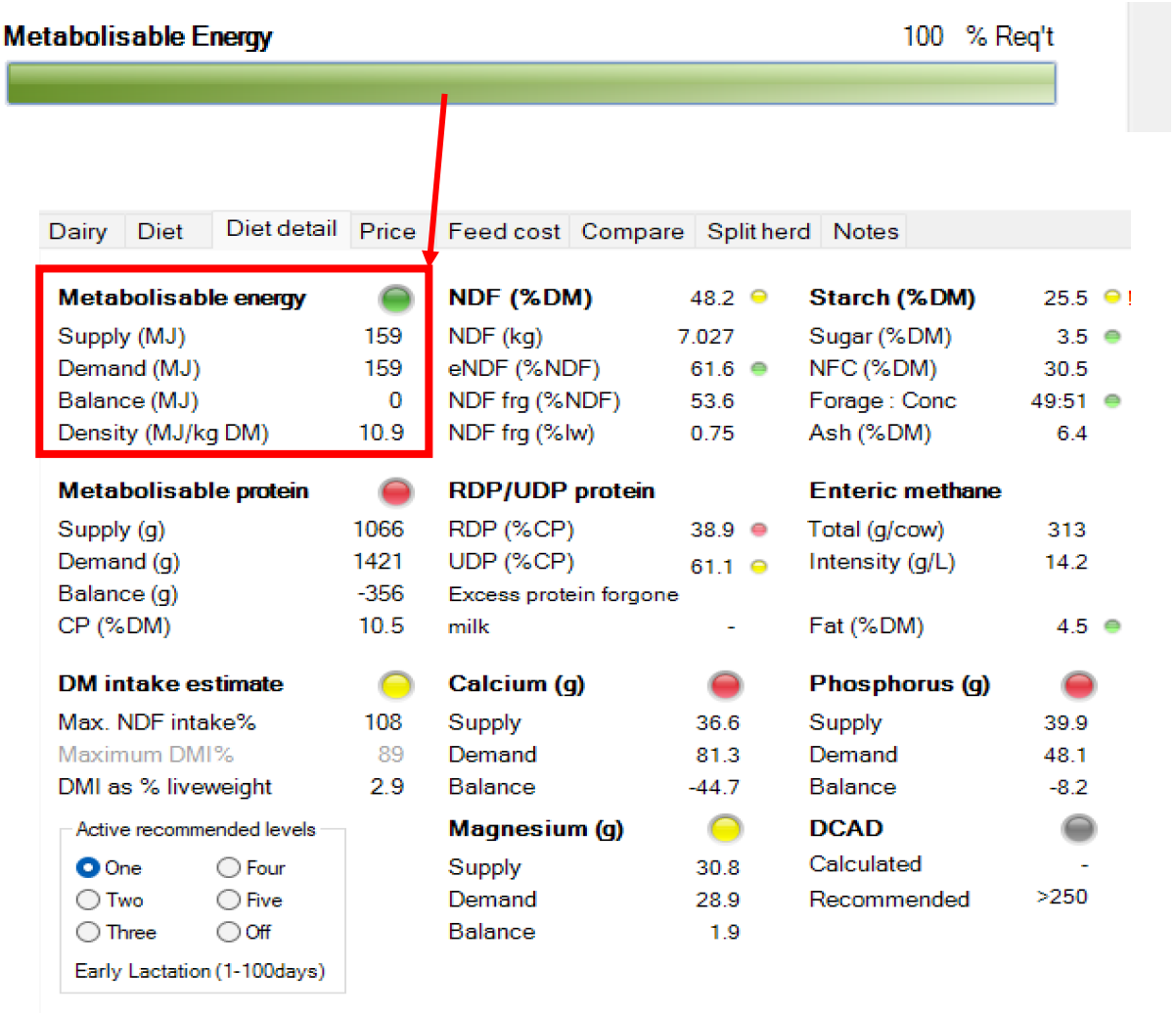
7. Ration Key Performance Indicators

- 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 the 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.



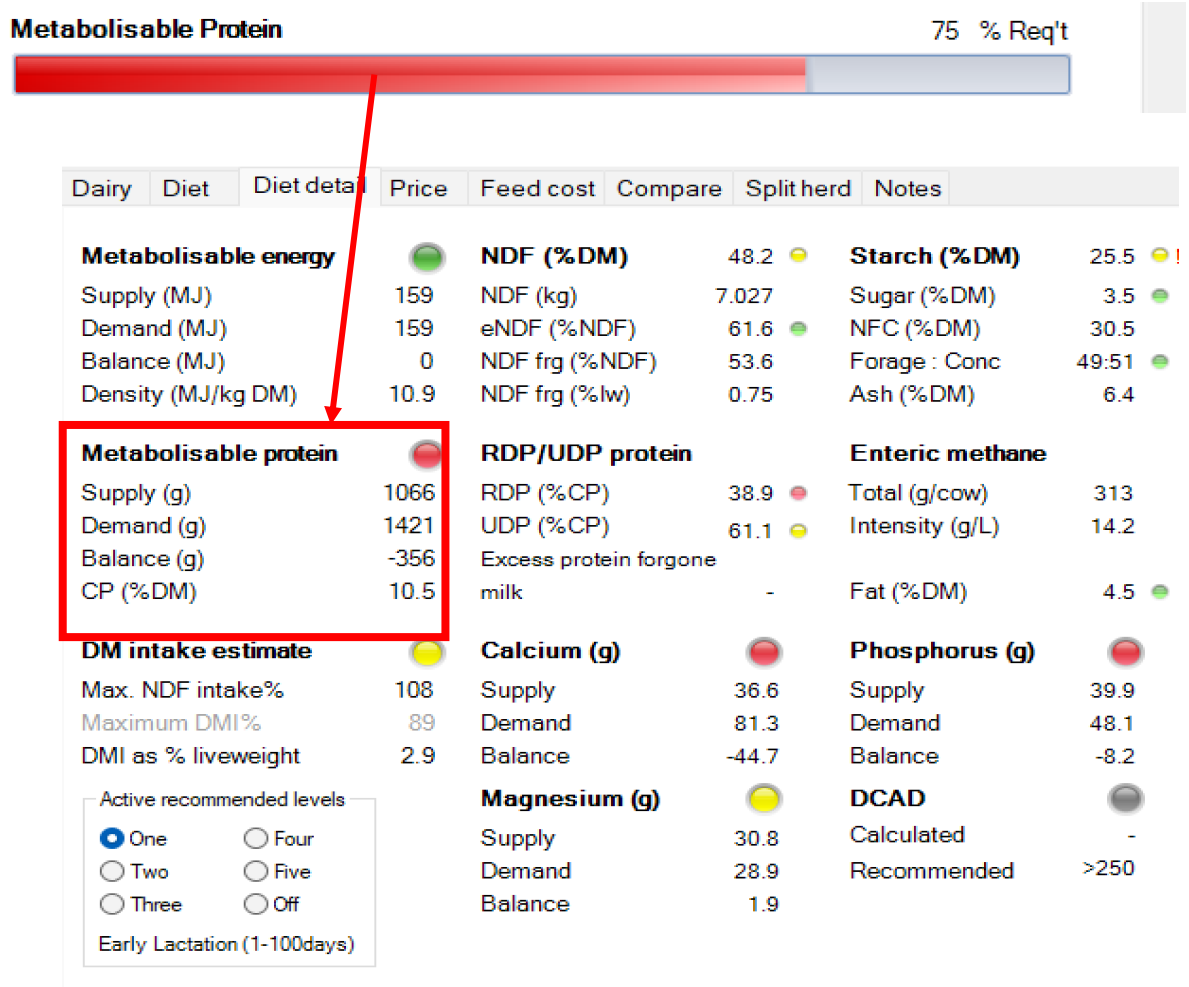
7.1 Metabolizable Energy

- The metabolizable energy (ME) is the main measure used to describe the energy requirements of the animal and the energy supplied in feeds.
- In this case the ration has the following details on the ME;
  - Supply (MJ): 159
  - The 'Demand' (MJ): 159
  - The difference between the Demand and supply is the 'Balance' (MJ): 0
  - The Density (MJ/Kg DM) of the ration is 10.9.
- The color code here has a green color meaning the demand has been met ('Balance' (MJ): 0).



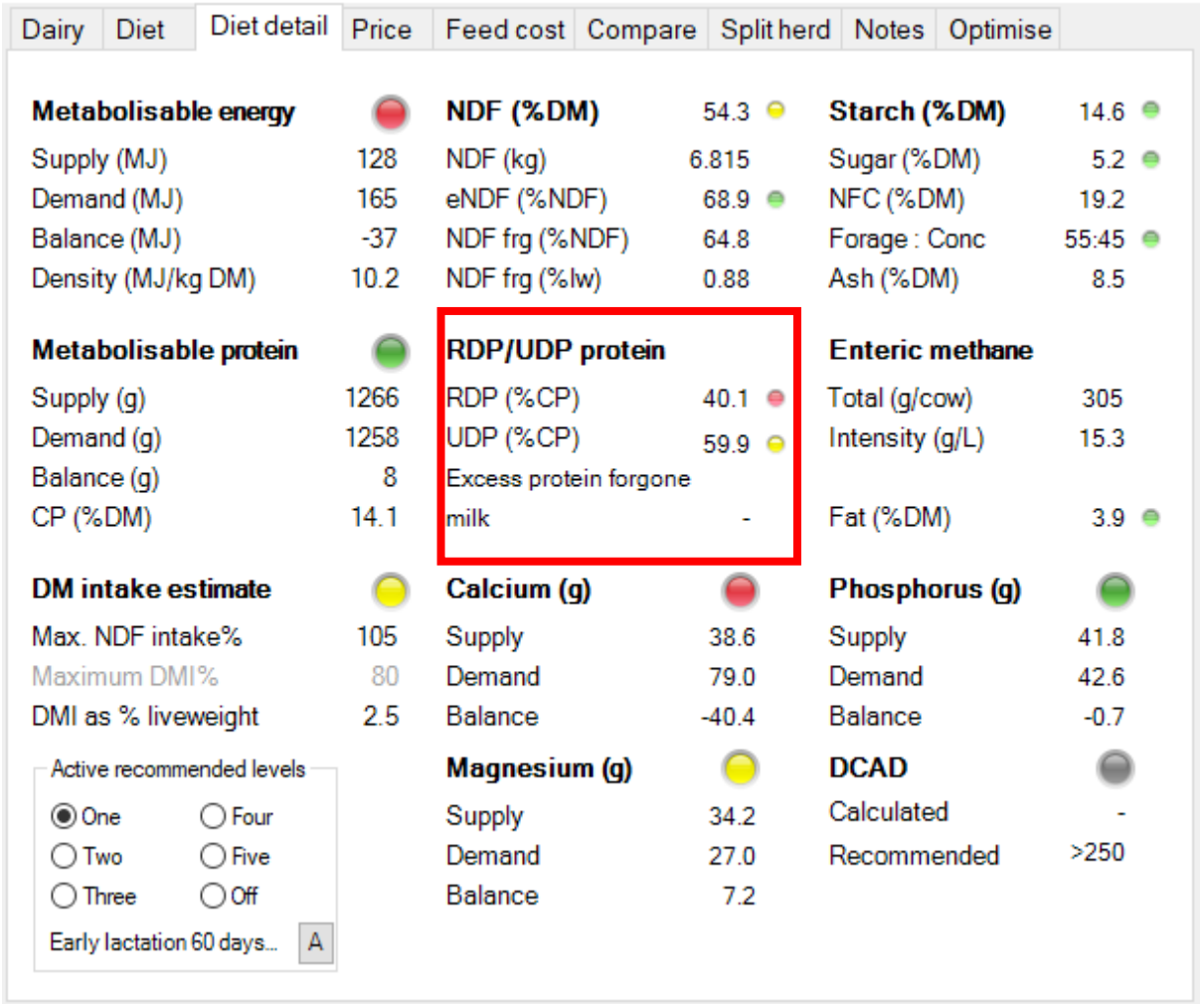
7.2 Metabolizable Protein

- Metabolizable Protein in ruminants is derived from two sources; microbial protein synthesized in the rumen and dietary proteins that escape rumen degradation.
- It is the measure of supply of protein in the ration. According to the current ration, the demand has not been met, hence the color red in the bar on the diet table. The (red box) shows more information about the diet, which are;
  - Supply (g): 1066
  - Demand (g): 1421
  - Balance (g): -356
  - That's is 1066/1421 X100%= 75% (red bar)



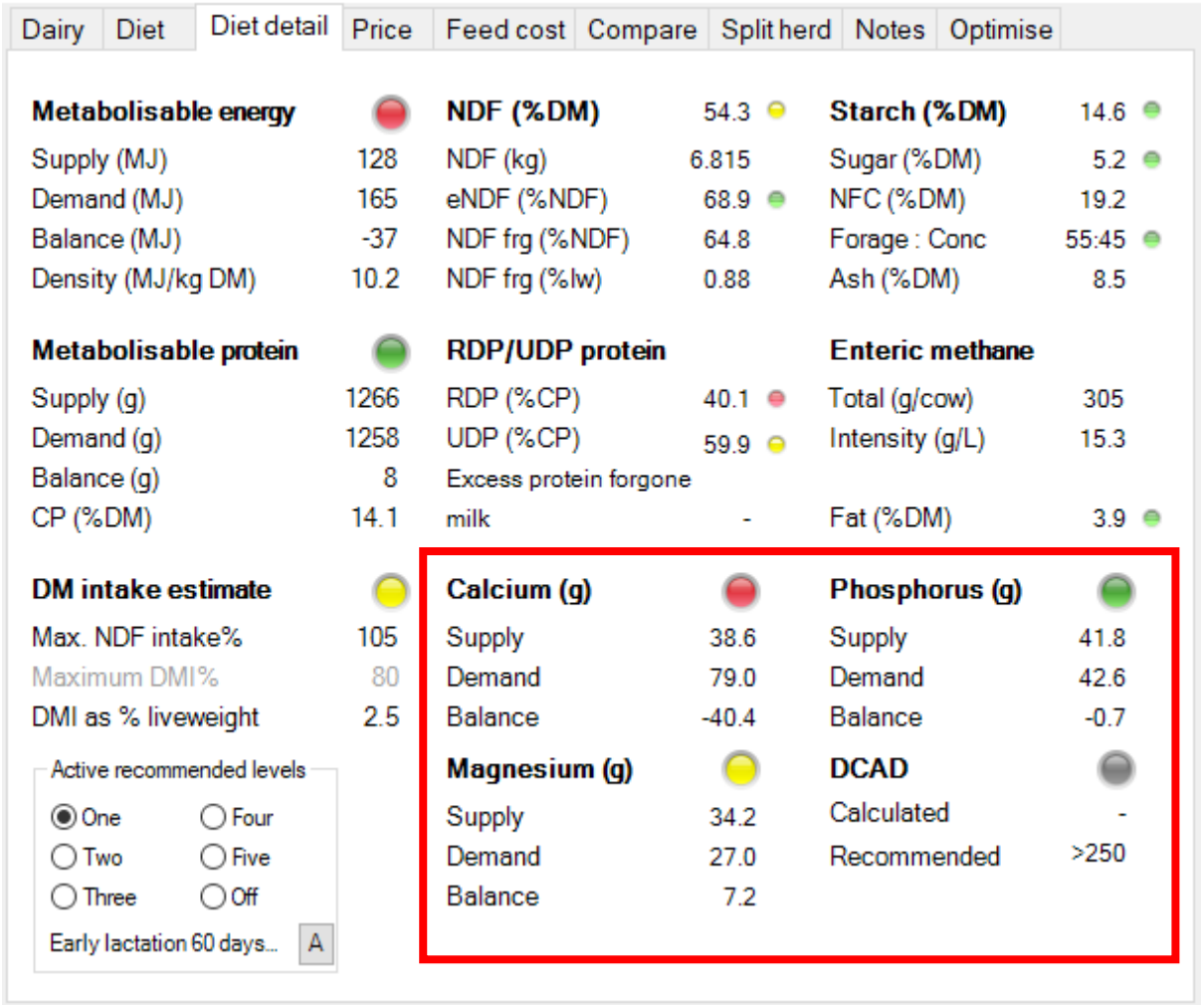
7.3 RDP/UDP Protein

- This is the measure of percentage of RDP (Rumen Degradable Protein) and UDP (Undegraded Dietary Protein) in the total amount of crude protein in the diet.
- The ration has both as follows in this example;
  - RDP (%CP) 40.1 – percentage of the dietary Crude protein that is rumen degradable.
  - UDP (%CP) 59.9 – percentage of the dietary Crude protein that is not degraded in the rumen.
- The two have a percentage target set that they should attain if the ration is well balanced; RDP - 65% and UDP - 35%.



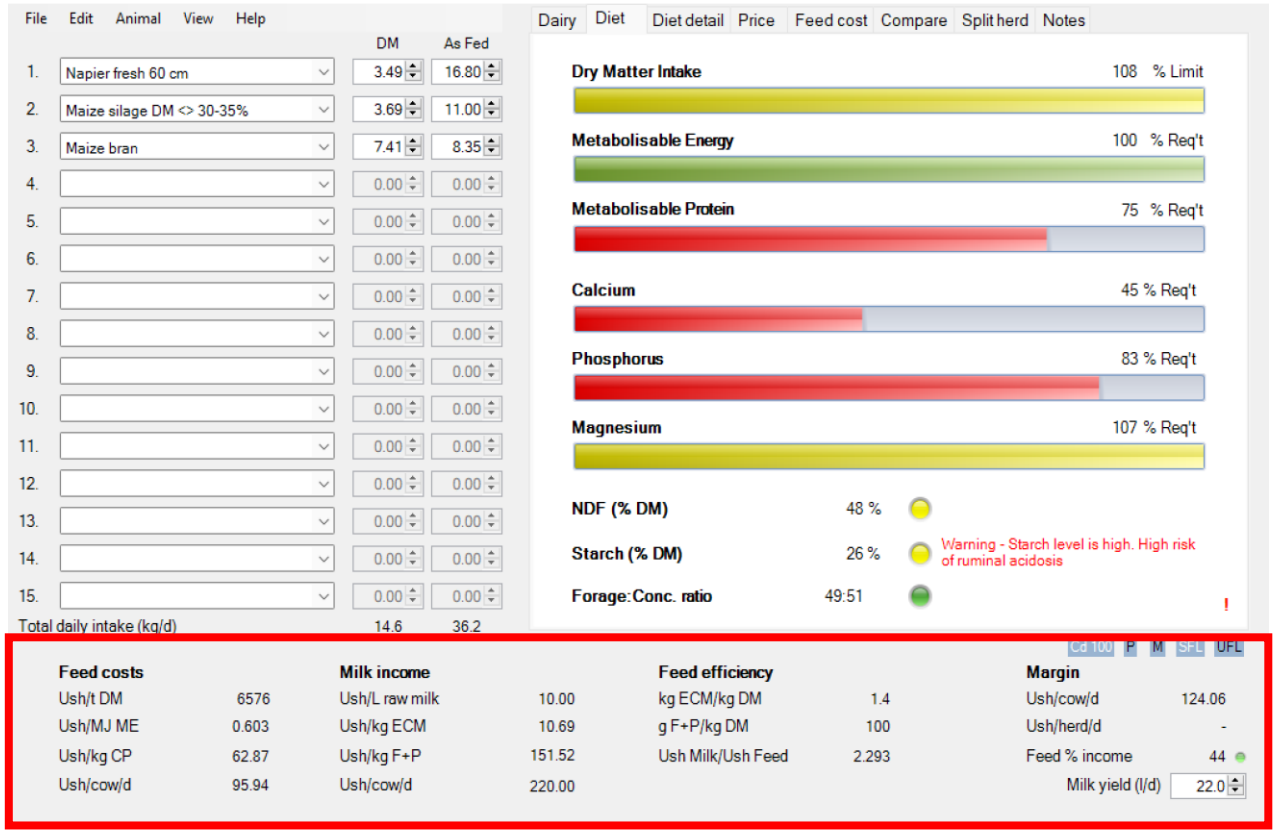
7.4 Minerals

- The three main minerals highlighted in the red box i.e., the demand, supply and balance (difference between demand and supply) are clearly shown to guide the user.
- The calculation is based on the mineral content in your feed ingredients. Rumen 8 calculates the total or accumulated amount for each mineral.
- A user will force the mineral after the DM, ME and CP are balanced.



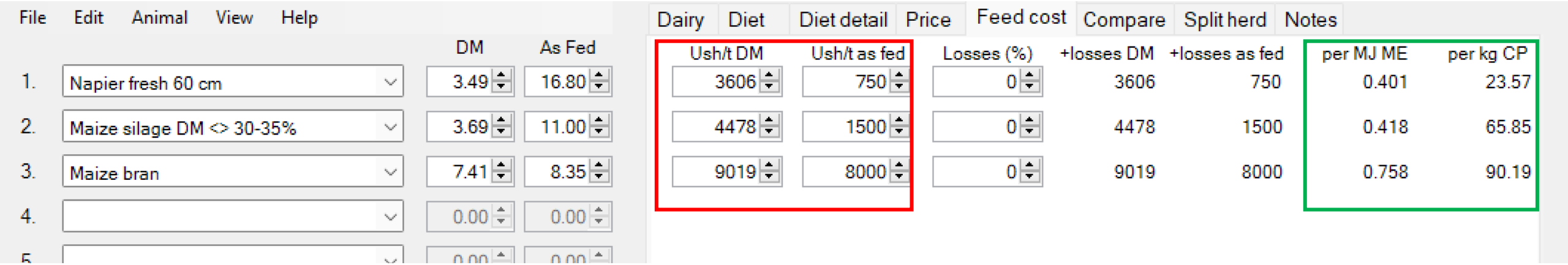
8. Feed Cost KPIs

- The feed cost is a key performance indicator that guides a user to formulate a ration using the cheapest feed ingredients.
- The aim is to formulate a healthy balanced ration at the same time maximizing the margin.
- The margin is an economical performance indicator that is affected by several factors;
  - Feed costs
  - Milk prices per liter/kilogram
  - Feed efficiency
  - Milk production per day.



8.1 Cost of a feed ingredient

- The cost of every ingredient used in a ration has its prices in tab ‘feed cost’. The prices of the feed ingredient are further broken down into;
  - Price per ton of dry matter (DM) (red box)
  - Price per ton of as fed feed ingredient (red box)
  - Price per megajoules of metabolizable energy (MJ M) (green box)
  - Price per kilogram of crude protein (per Kg CP) (green box)
- The consultant/user needs to identify the cheapest feed ingredient terms of ME and CP(blue box) within the limitations of formulating a healthy ration. In this case, energy (ME) and protein (CP) are cheapest produced when Napier grass is fed; Ush.0.401 per MJ and CP Ush.23.57 per kg. This helps the user to select a cheap ingredient and use it in high quantities targeting high margins.

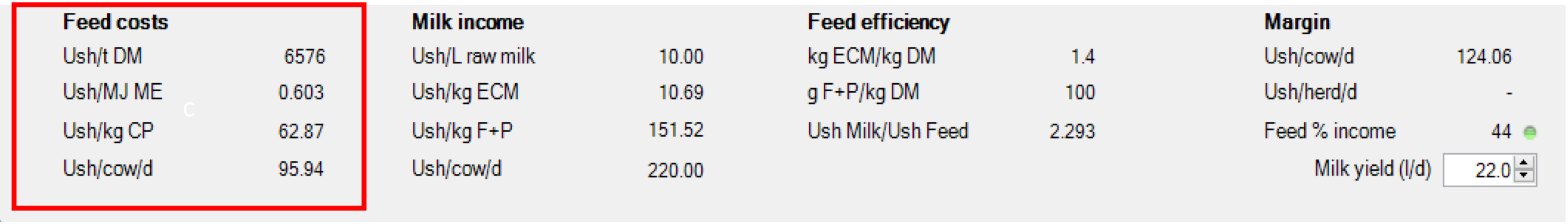


8.2 Feed cost

- At the bottom (red box) of the Rumen8 landing page you will find the key performance indicator ‘Feed cost.’
- The feed cost constitutes the following values;

  - The feed price expressed per ton of dry matter - Ush/t DM, 6576
  - The feed dry matter cost expressed per megajoule Of ME of feed - Ush/MJ M, 0.603
  - The feed dry mater cost expressed per kilogram of crude protein in the feed - Ush/kg CP, 62.87
  - The feed dry matter cost expressed per cow per day - Ush/cow/d, 95.94

- The feed cost per cow per day is used to calculate the margin after identifying the cost of milk per liter and production of a cow per day.



8.3 Milk income

- This is a KPI required to compare with the feed costs. The milk income parameters constitute for example;
  - Milk income expressed per liter of raw milk: Ush/L raw milk, 10.00 (milk price per liter)
  - Milk income expressed per kilogram of energy corrected milk: Ush/kg ECM, 10.69
  - Milk income expressed per kilogram of milk fat plus protein: Ush/kg F+P, 151.52
  - Milk income expressed per cow per day: Ush/cow/d, 220.00.

Feed costs		**Milk income**		**Feed efficiency**		**Margin**	
Ush/t DM	6576	Ush/L raw milk	10.00	kg ECM/kg DM	1.4	Ush/cow/d	124.06
Ush/MJ ME	0.603	Ush/kg ECM	10.69	g F+P/kg DM	100	Ush/herd/d	-
Ush/kg CP	62.87	Ush/kg F+P	151.52	Ush Milk/Ush Feed	2.293	Feed % income	44
Ush/cow/d	95.94	Ush/cow/d	220.00			Milk yield (l/d)	22.0

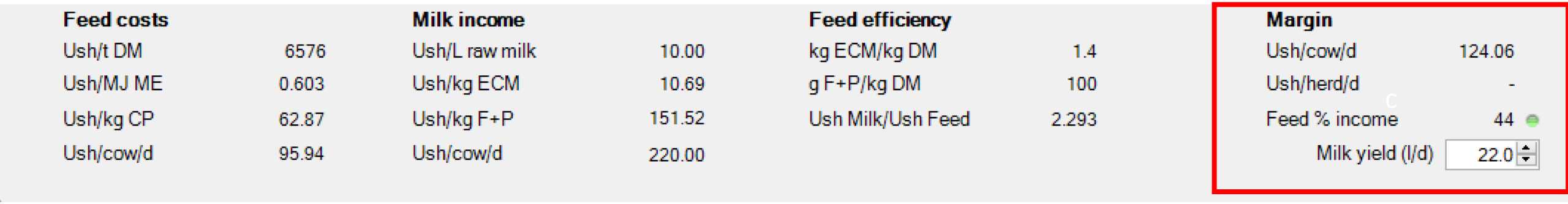
8.4 Feed efficiency

- This is a KPI required to demonstrate the feed efficiency of a ration. The feed efficiency constitutes the following parameters;
  - Feed efficiency expressed as a kilogram of energy corrected milk per kilogram of dry matter eaten: kg ECM/kg DM, 1.4.
  - Feed efficiency expressed as grams of milk fat plus protein per kilogram of dry matter eaten: g F+P/kg DM, 100.
  - Feed efficiency expressed as milk income per Uganda shillings of feed dry matter cost: Ush milk/Ush feed, 2.293.

Feed costs		**Milk income**		**Feed efficiency**		**Margin**	
Ush/t DM	6576	Ush/L raw milk	10.00	kg ECM/kg DM	1.4	Ush/cow/d	124.06
Ush/MJ ME	0.603	Ush/kg ECM	10.69	g F+P/kg DM	100	Ush/herd/d	-
Ush/kg CP	62.87	Ush/kg F+P	151.52	Ush Milk/Ush Feed	2.293	Feed % income	44
Ush/cow/d	95.94	Ush/cow/d	220.00			Milk yield (l/d)	22.0

8.5 Margin

- Margin is the difference between milk income and feed costs. It is one of the most important aspects while formulating a ration. The margins can be looked at as follow;
  - Margin expressed per cow per day: Ush/cow/d, 124.06.
  - Margin expressed per herd per day (Ush/herd/d). This is simply the margin per cow multiplied by the number of cows in the herd.
  - Margin expressed as daily feed cost as a percentage of income (44%). This means the feed cost is 44% of the income. When the feed cost is above 60% of the income, it is concluded that the cost of milk production is high. It is advised to keep the cost of production lower than 60% to achieve better margins.
- The color code also indicates feed dry matter as a percentage of income indicator; Red – low efficiency, green recommended and Yellow – high efficiency.



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Ush/t DM	6576	Ush/L raw milk	10.00	kg ECM/kg DM	1.4	Ush/cow/d	124.06
Ush/MJ ME	0.603	Ush/kg ECM	10.69	g F+P/kg DM	100	Ush/herd/d	-
Ush/kg CP	62.87	Ush/kg F+P	151.52	Ush Milk/Ush Feed	2.293	Feed % income	44
Ush/cow/d	95.94	Ush/cow/d	220.00			Milk yield (l/d)	22.0

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