USE OF RUMEN8 SOFTWARE FOR RATION CALCULATION (Level 3 – Part II)

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.

❑ Step by step guide to making a ration for dairy cows.

❑ Examples of the rations for various categories of cattle.

⚠️ **IMPORTANT**

*This module has two parts; this is part II – ensure you download Part I.*

Rumen8

2. Case study 1: Reduce milk yield

- According to the result of the original feed ration, the cow's requirement to produce 15L is not met.
- We can adjust the milk to get to the estimated level of production if the cows are fed with this ration.
- On the bottom right of the landing (green box) reduce the milk production and target to settle on a level where the bars turn green, especially the metabolizable energy (red box).
- The picture on the right shows that for the ration provided in this case cows can only produce 7.1L/d (green box).

3. Case study 1: Improve forage quality - Napier grass

- Advise the farmer to harvest the forage at an earlier vegetative stage and improve silage quality.
- In this case (blue box) use Napier grass harvested at an average of 60 cm high instead of overgrown height of 150 cm.
- Try out using the improved forages in your ration to achieve a balance. Maintain the same amount of forage and milk (green box) then notice the difference in the bars.
- We can see that the percentage of metabolizable protein and energy in the dry matter of the forages are of better quality(red box) if harvested at the right stage.
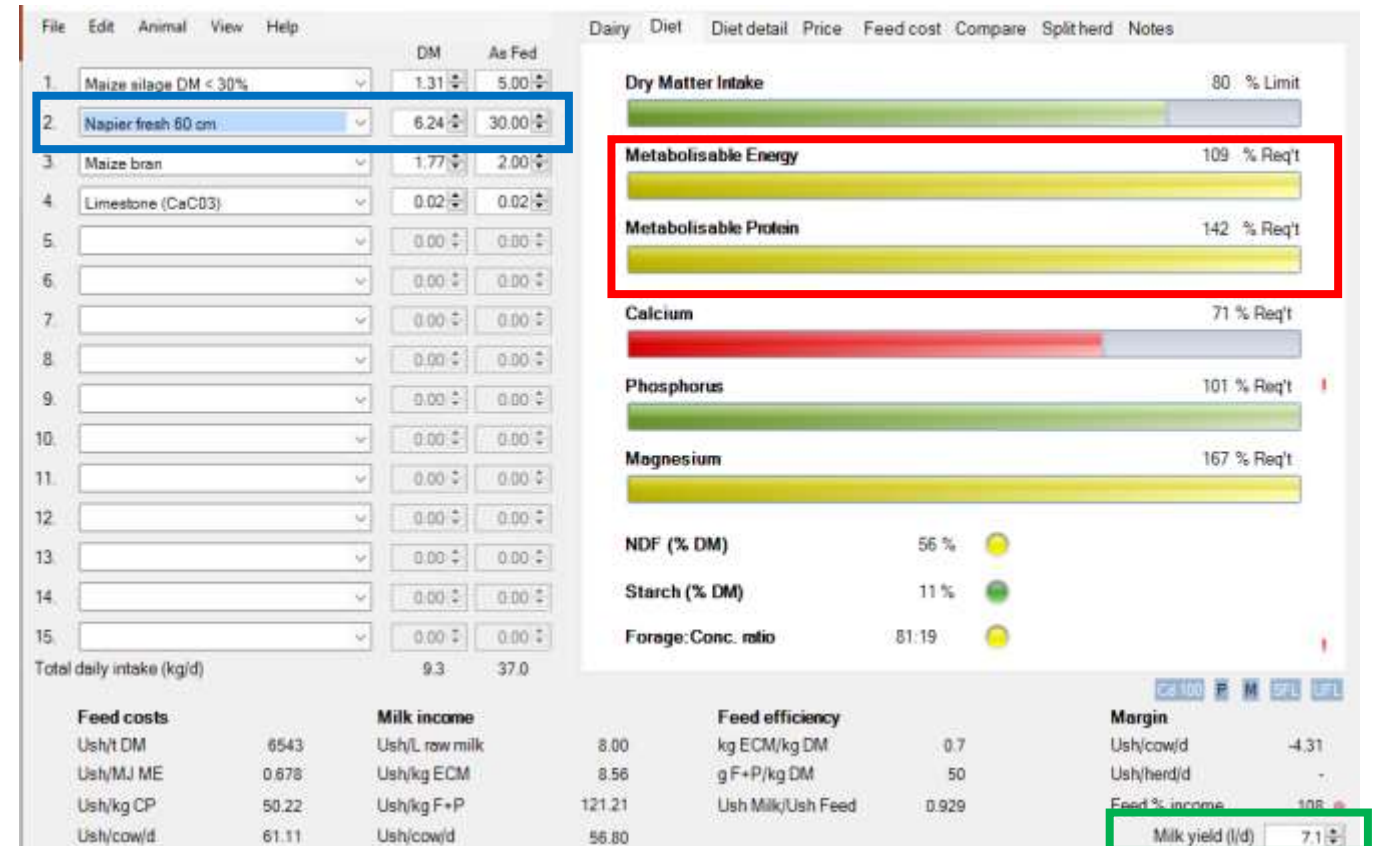
4. Case study 1: Improve forage quality - Maize silage

- Improve the quality of maize silage also. Notice the dry matter content improved from less than 30% to more than 30% (blue box).
- The red box shows the outcome to be better than the quality of ration before.
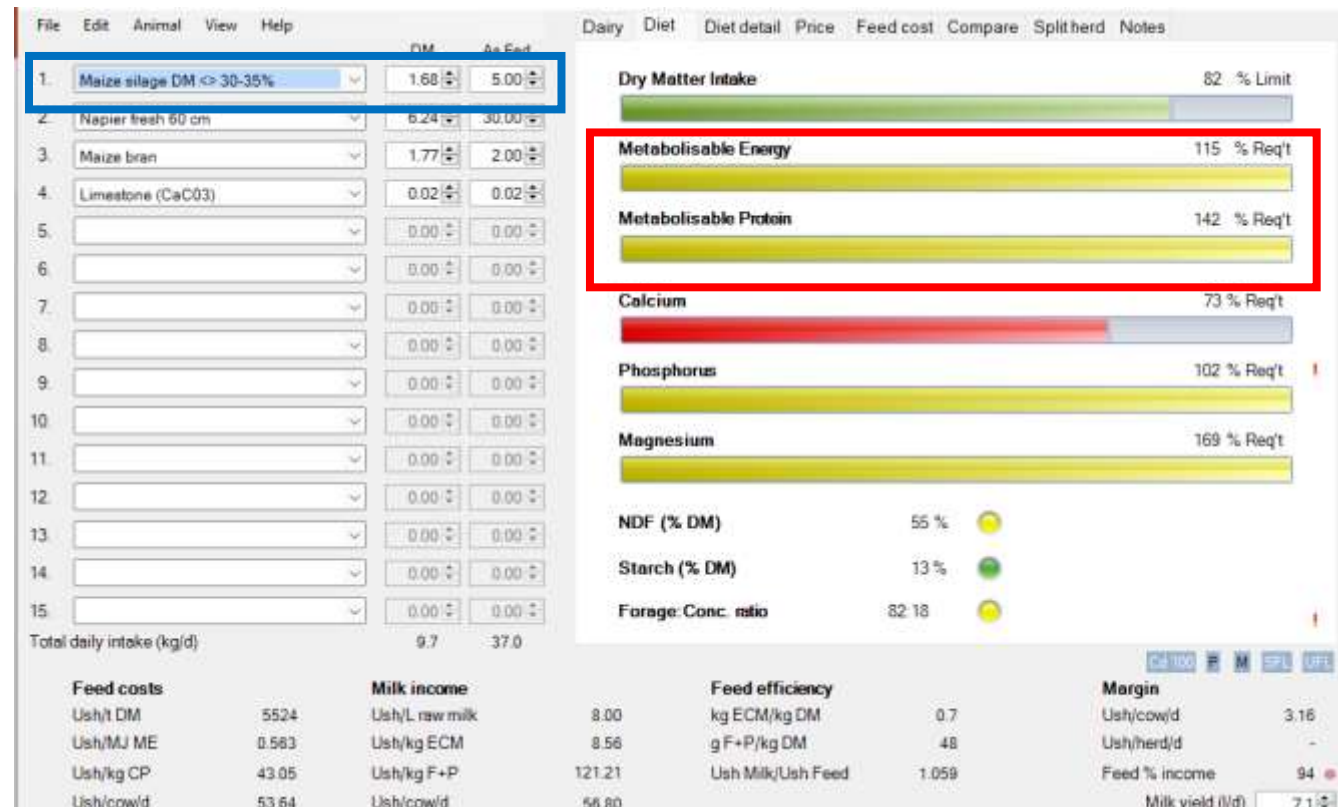
5. Case study 1: Increase milk yield after improving forage quantity

- After using better quality forages (blue box), the metabolizable energy (ME) and metabolizable protein was oversupplied for the cow producing 7.1 L/d.
- The ration with these better quality forage can only produce 9.4L/d (green box) with margins - a low of Ush.22.56.
- How to calculate the margin is explained in the next slide.
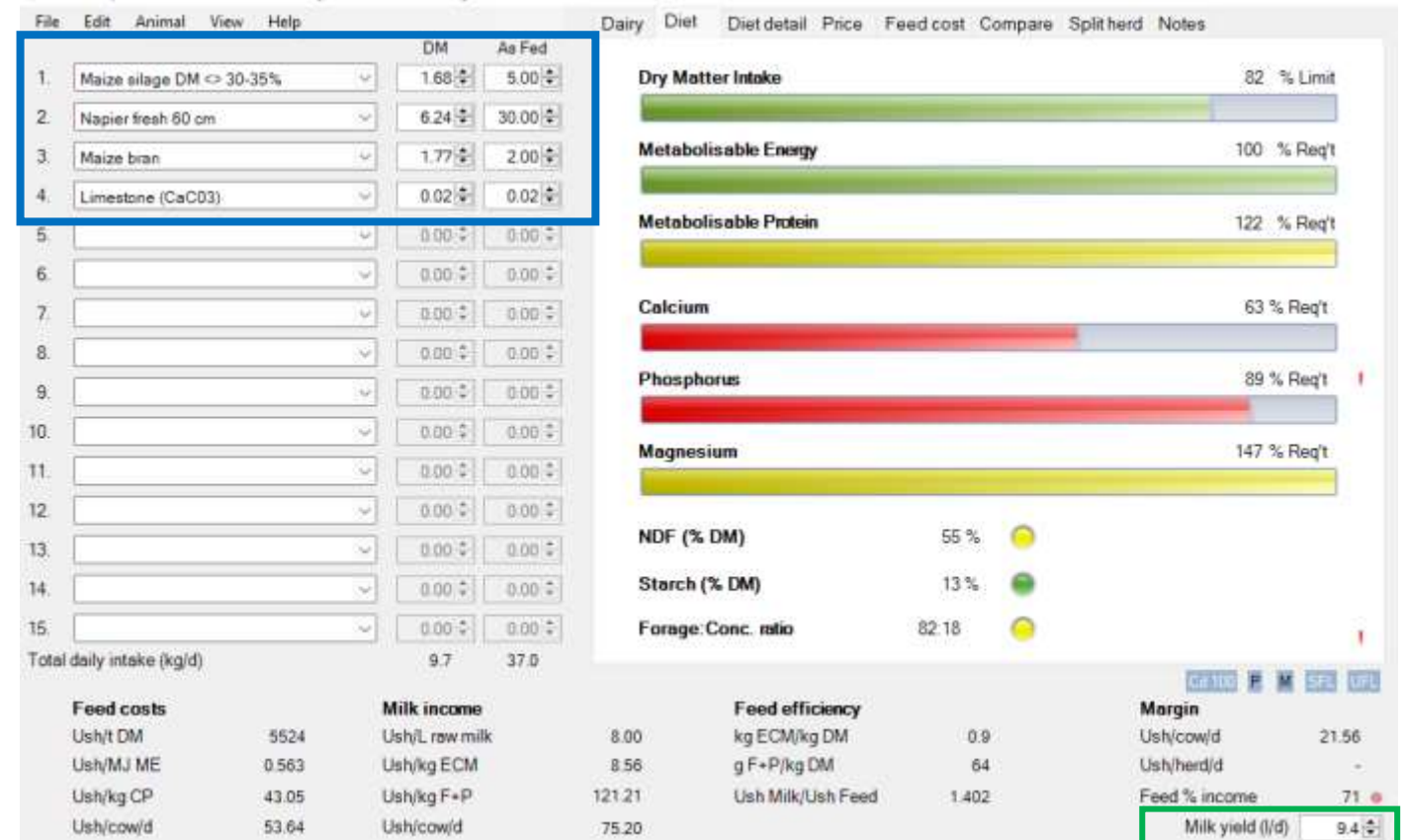
6. Case study 1: Margin calculation

- At the bottom of the Rumen8 landing page, you can find the display 'Feed cost', 'Milk income' and 'Margin'. From the original feed ration and cows producing 9.4 L/d, the following are the costs;
  *Note: For all prices in this example the currency divisor is 100 (Cd 100).

  - Feed cost; Ush.53.64/cow/d (red box)
  - Milk income; Ush.75.20/cow/d (green box)
  - Margin; Ush.21.56/cow/d (Margin = Milk price - Feed cost) (blue box)

- While making the ration always put in mind the margin. Your goal should be getting the highest margins.

15.		0.00	0.00	Forage:Conc. ratio	82:18			!
Total daily intake (kg/d)		9.7	37.0					

Cd 100 P M SFL UFL

Feed costs		Milk income		Feed efficiency		Margin	
Ush/t DM	5524	Ush/L raw milk	8.00	kg ECM/kg DM	0.9	Ush/cow/d	21.56
Ush/MJ ME	0.563	Ush/kg ECM	8.56	g F+P/kg DM	64	Ush/herd/d	-
Ush/kg CP	43.05	Ush/kg F+P	121.21	Ush Milk/Ush Feed	1.402	Feed % income	71
Ush/cow/d	53.64	Ush/cow/d	75.20			Milk yield (l/d)	9.4

7. Case study 1: Dry matter intake

- There is room for the cow to eat more since the current dry matter intake (red box) is 82%. We can add more feed ingredients and focus on increasing margin.
- When you increase the feed ingredients to achieve the recommended dry matter intake of a 500kg cow, you will notice other bars will increase their percentages too.
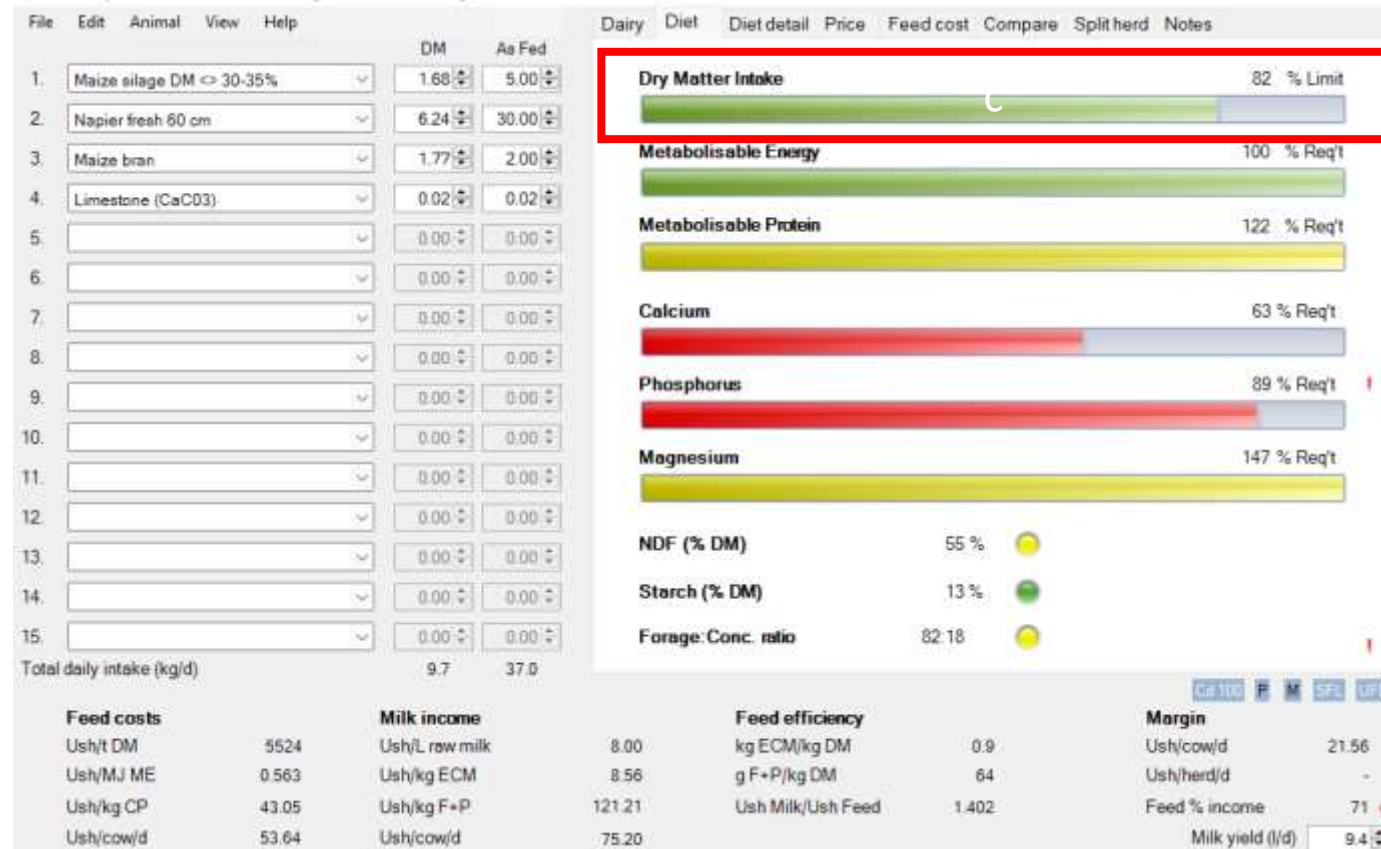
8. Case study 1: Dry matter intake Cont'd…

- Before you take any step to adjust the feeds ingredients in the ration, a consultant should consider the following;
  - The seasons and forage availability(quantity); wet and dry season,
  - The quality of forage,
  - The cost of nutritive value of the feeds i.e. the cost of crude protein (CP) and metabolizable energy(ME). Use the cheapest and readily available.
  - Achieving high margin rather than milk quantity i.e. try to optimize the milk production and maximize the margin.

9. Case study 1: Feeds cost nutritive value of feeds ingredients

- Tab 'feed cost' clearly indicated the cost/price of every feed ingredient. The red box shows the feed cost per ton as fed and per dry matter of a feed-in ton. You can edit any figure here in case of different prices in your locality or in case of price changes in the market.
- The blue box shows the price of ME in Mega joules (per MJ ME) and the price per kg of crude protein (per kg CP) per ration ingredient.
- As a consultant you need to identify the cheapest feed ingredient terms of ME and CP (blue box) within the limits of formulating a healthy ration. In this case, energy (ME) and protein (CP) are produced the cheapest when Napier grass is fed (no feeding losses are assumed).

			DM	As Fed	Ush/t DM	Ush/t as fed	Losses (%)	+losses DM	+losses as fed	per MJ ME	per kg CP
1.	Maize silage DM <> 30-35%	∨	1.68	5.00	4478	1500	0	4478	1500	0.418	65.85
2.	Napier fresh 60 cm	∨	6.24	30.00	4808	1000	0	4808	1000	0.534	31.42
3.	Maize bran	∨	1.77	2.00	9019	8000	0	9019	8000	0.758	90.19
4.	Limestone (CaC03)	∨	0.02	0.02	7500	7500	0	7500	7500	0.000	0.00
5.		∨	0.00	0.00							

File   Edit   Animal   View   Help   Dairy   Diet   Diet detail   Price   Feed cost   Compare   Split herd   Notes

10. Case study 1: Feeding during the wet season

- Try to utilize the natural resources the farmer has. However, consider the quality of the forages that may be available.
- Low-quality forages such as maize stover, banana pseudo stems, or rice straw may be available in plenty but will not meet the nutritional requirement of dairy cows.
- Advice farmers to use available green forages at the most nutritious growing stage. During the wet season conserve surplus in the form of silage or hay for dry season.

10.1 Case study 1: Feeding during the wet season Cont'd…

- During the wet season fresh-cut Napier grass is available for feeding the cows.
- Maize silage can be preserved for dry season when Napier grass is scarce or not available.
- Start by feeding the cow some Napier grass (enter the kilograms fed y farmer in the 'As fed').

- The dry matter intake (potential) bar will turn green in color.
- Notice the other bars (Me, MP, Ca, P, Mg) turn yellow meaning there is oversupply of ME, MP and minerals.
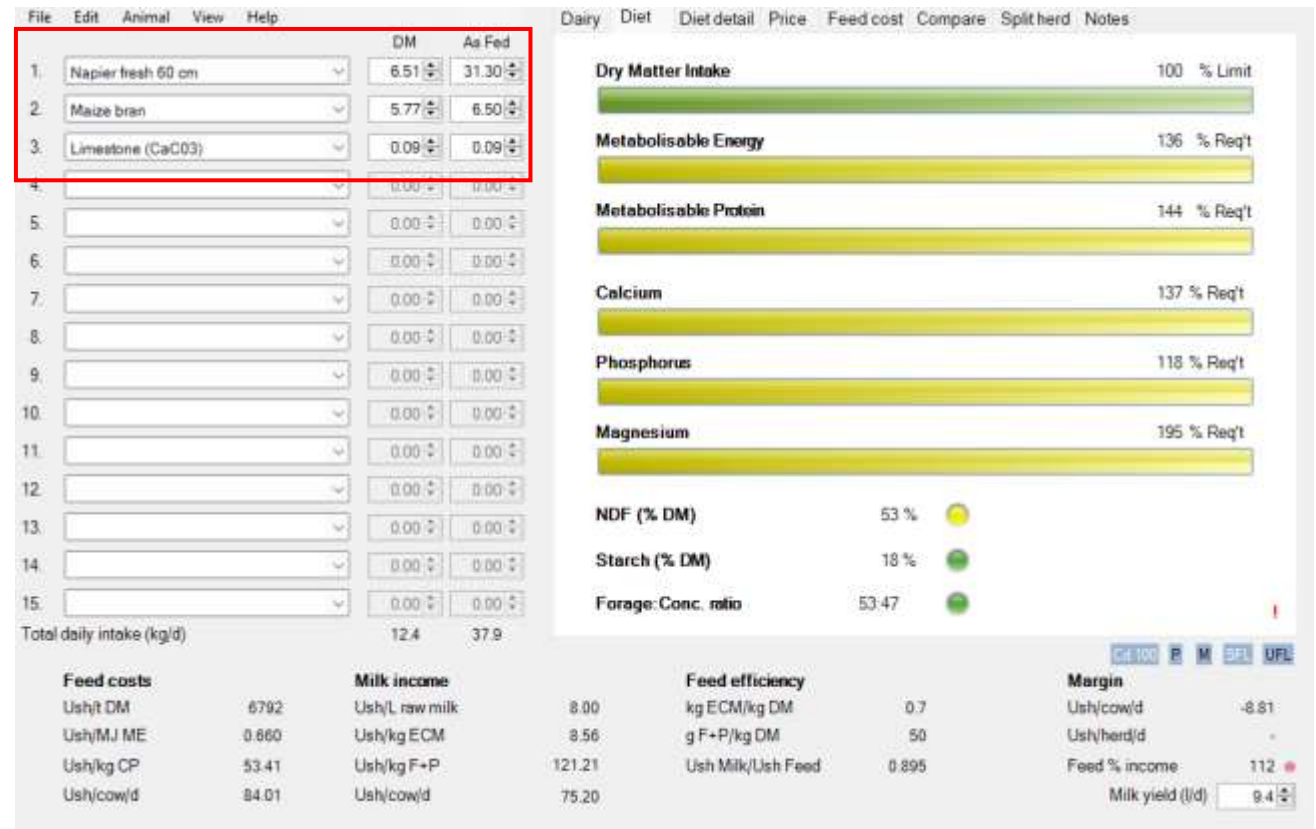
11. Case study 1: Napier grass as the main forage

- With the oversupply of these feed ingredients, the cow can produce more than 9.4 L/d.
- Increase (red arrow) the milk yield (red box) until the oversupplied metabolizable energy (ME) bar turns green.
- Metabolizable protein (MP) is now supplied at 108% of the total requirement of the cow.

  *Note: With the increase of milk the margin also increases.

- The only component which is now deficient is the mineral phosphorus, with the red bar.

12. Case study 1: Mineral supplements

- The farmer was only supplementing with limestone and from the previous slide, you noticed that phosphors requirement was not met.
- Add a mineral supplement for lactating cows. For example in our case, mineral 'Maclick Super'.
- The provided mineral supplement, 'Maclick Super' contains a wide range of minerals among others calcium, phosphorus, magnesium as per the label on the packaging.

13. Case study 1: Ration 1 - Wet seasons

- The farmer can feed this ration to each cow in early lactation stage. The feed ingredients can be mixed into a total mixed ration. Also, maize bran and the minerals can be mixed as a compounded feed mix and fed 3-4 times per day in separate feedings.
- Assuming management is constant, the cows will be able to produce an average of 15.7L/d and a margin of Ush.39.70 per cow per day (red box).

  *Note: For all prices in this example the currency divisor is 100 – so multiply Ush.39.70 by 100 to get the correct figure of Ush.3970.
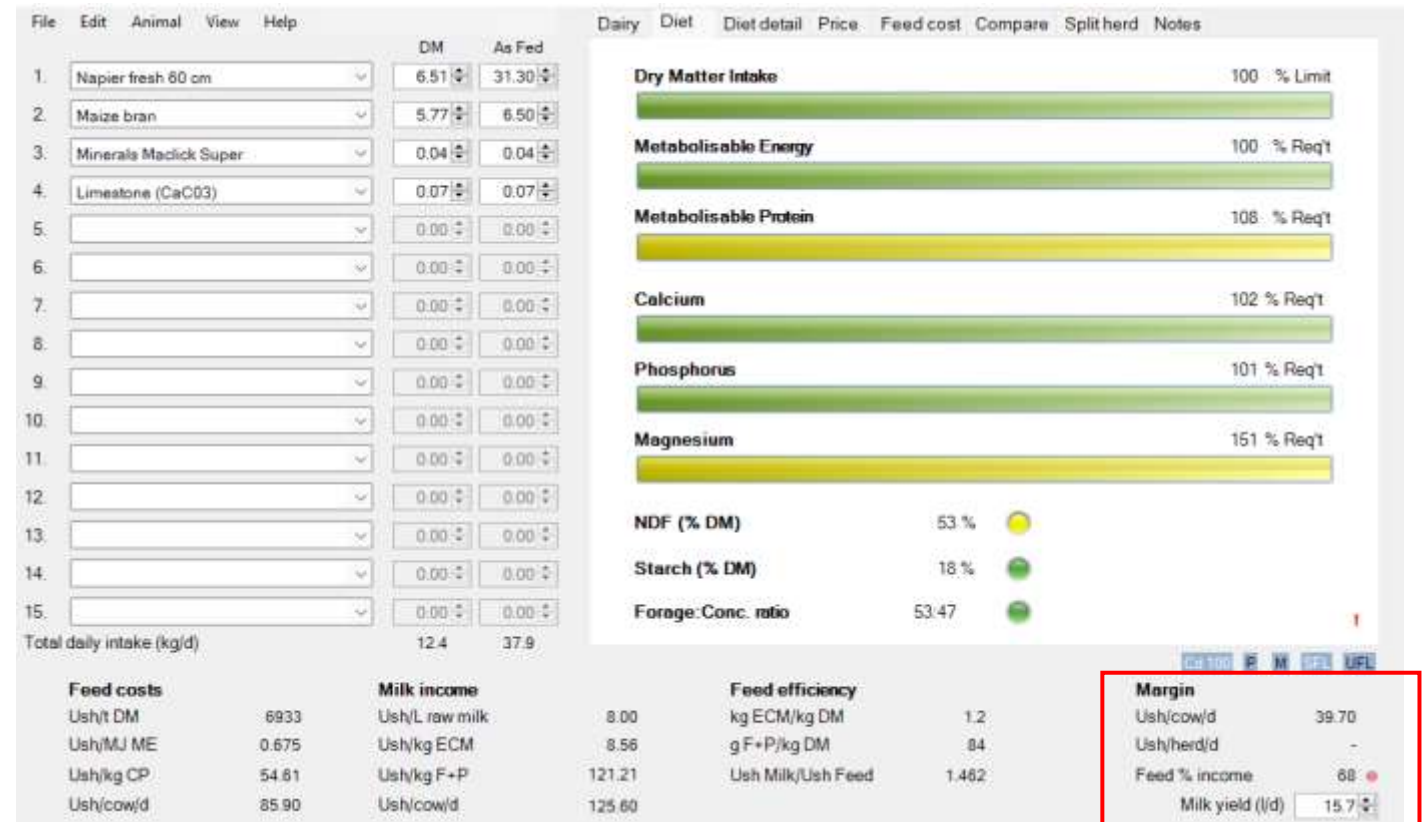
14. Case study 1: Save ration 1

- Save the first ration (blue box) under the 'Compare' tab this will allow you to make more alternative rations for the farmer to compare the different types and quantities of feed ingredients against the margin.
- Click the 'Compare' tab, then click 'S' (red box) for saving ration one.
- Name the ration as 'Wet season ration'.
- After saving the first ration you can go back to make other alternative rations.

15. Case study 1: Dry season ration

- During the dry season, the farmer can for example feed his cows with the Maize silage.
- Replace Napier grass with maize silage and formulate a ration with other available feeds (red box).
- When you enter the kilogram of Maize silage fed to the cow to meet the Dry matter intake potential, you see a warning on the screen that the starch level is high and the cow is at a higher risk of experiencing ruminal acidosis (green box).
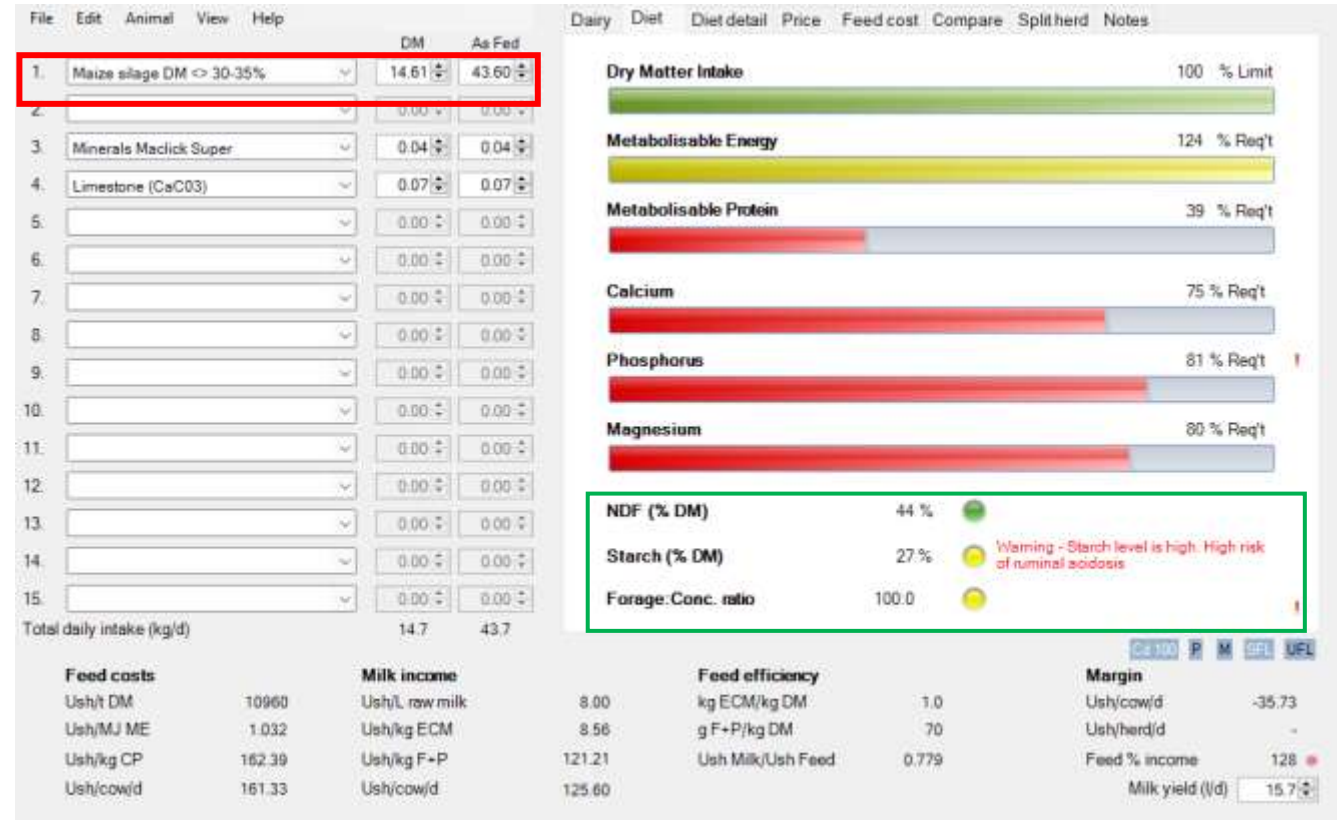
16. Case study 1: Introduce wet Brewers spent grain

- Feeding maize silage only will show that the protein requirement is not covered (MP is at 56% of the requirement). This means a milk yield of 15.7L/d is not likely.
- In this case we would need to introduce a protein-dense feed ingredient. For example in our case, wet brewers spent grain.
- Now you can try to balance the ration using maize silage and wet brewers spent grain by increasing or decreasing the amount as fed.
- When metabolizable energy requirement is met for the cow producing 15.7L/d, MP, Ca, P, and Mg requirements are not met.

17. Case study 1: Dry season ration milk price

- Note that at the first instance we assume that the milk price has not changed (red box).
- The aim is to formulate a healthy balanced ration at the same time maximizing the margin.
- In our case wet brewers' spent grain is cheap but prices of feed ingredients may differ in a different location in the country.

18. Case study 1: Ration 2

- When balancing, remember to pay attention to the recommended forage to concentrate ratio, NDF content in the ration (as a percentage of DM) and starch content in the ration (on DM basis).
- After ME and MP are balanced, add mineral mixtures to meet the mineral requirements of the cows.
- With this ration as depicted in the picture alongside, the cow can produce 18L/d in the dry season.

19. Case study 1: Save the dry season ration

- Save this ration under the tab 'Compare' as ration 2 and name it 'Dry season ration'.
- You can make another alternative ration to compare with the dry season ration.

20. Case study 1: Further improvement of dry season ration

- The previous ration (dry season ration) was not completely balanced after viewing the tab 'diet detail'.
- Based on the metabolizable protein (ME) requirement information on the tab 'Diet detail' we have an oversupply of BY 35g (red arrow).
- However, the rumen degradable protein (RDP) and undegradable protein (UDF) ratios (red box) are not balanced i.e. they are not at the recommended nutritive level.
- To utilize this balance of metabolizable protein we can introduce an energy-dense feed ingredient.

| Dairy | Diet | Diet detail | Price | Feed cost | Compare | Split herd | Notes |

21. Case study 1: Introduce Molasses in ration 3

- For this example, introducing molasses as an energy-dense feed ingredient improves the margin and maintains the high milk yield with a balanced ration.
- Molasses does not have NDF meaning it should affect dry matter intake.
- This ration closely meets the cow's requirement and can be fed during the dry seasons compared to the previous dry season ration.
- Save this ration under the tab 'Compare' as ration 3 and name it 'Dry season balanced ration'.
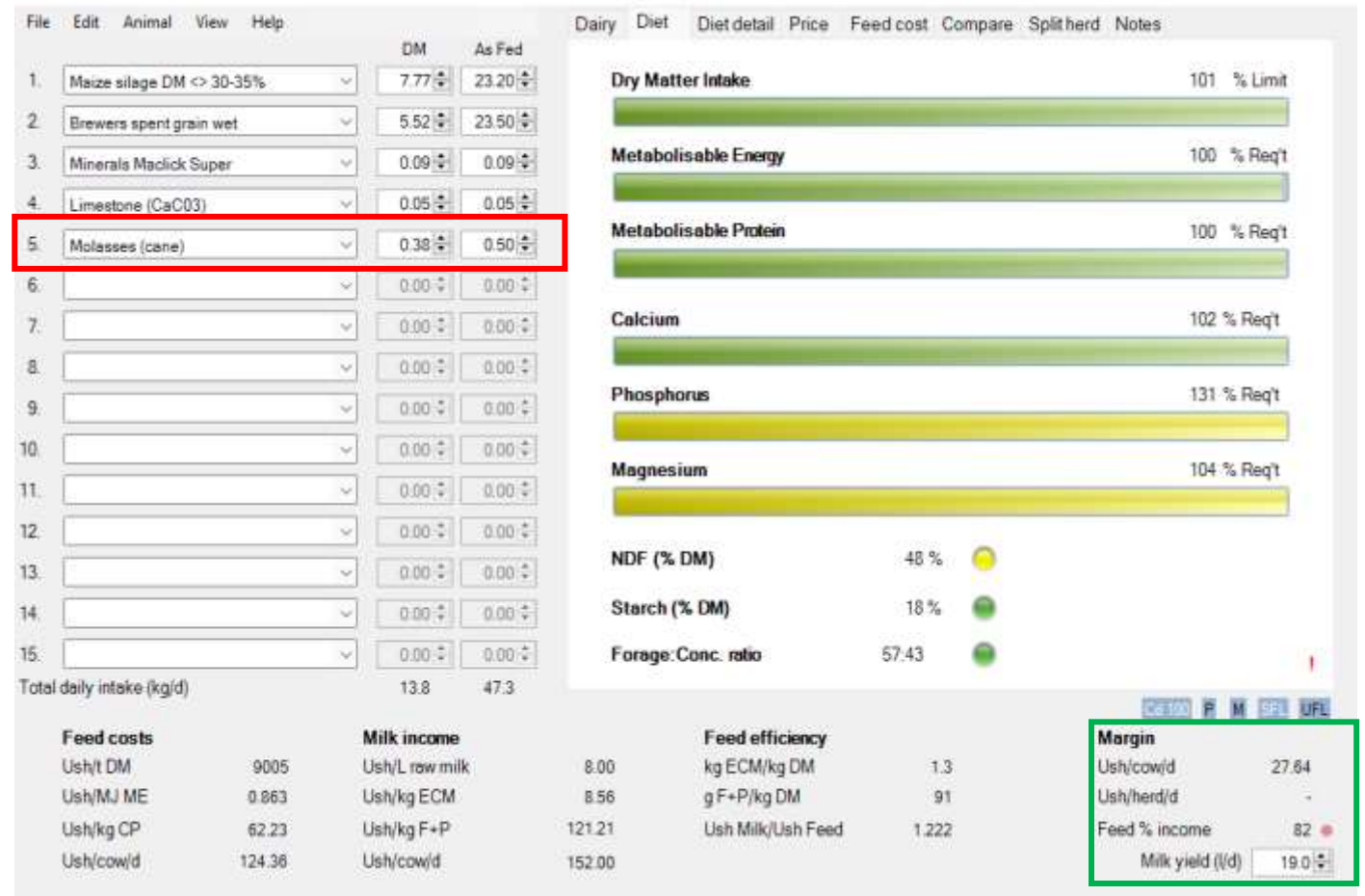
22. Case study 1: Introduce maize grain

- For this example, introduce maize grain as an energy-dense feed ingredient alternative to molasses in order to achieve a balanced ration.
- Maize grain has NDF hence affecting the dry matter intake. Therefore, introducing maize grain will mean reducing the other feed ingredient so as to give room for maize grain.
- The picture shows a result of ration after using maize grain.

23. Case study 1: Ration 4 - with maize grain

- The margin is seen to be the highest of the three rations formulated before. This can also be an alternative during the dry season.

- This ration 4 has the highest margin in the dry season. Compare the margin highlighted by the red box and green box for the ration with maize grain.

24. Case study 1: Making ration 4 completely balanced

- To further balance the ration, always view the tab 'Detail diet'.
- From the ration with maize grain the rumen degradable protein (RDP) and undegradable protein (UDF) ratios (red box) are not balanced i.e. the ration does not meet the recommended nutritive level of 65%:35% respectively.
- Save this ration as 'Dry season ration 4' at the tab 'Compare' by replacing the ration with molasses.

25. Case study 1: Ration 4 diet detail information

- Rumen degradable protein(RDP) and undegradable protein (UDF) ratios (red box) are now balanced i.e. the ration meets the recommended nutritive level.
- This is after adding protein source ingredients to balance the RDP and UDP at 65%:35% respectively.
- With this healthy balanced ration, the margin is lower than the recent rations.

26. Case study 1: Compare all rations

- In the tab 'Compare' you can view three rations while in the other section on the left-hand side; while at the bottom you can view the balanced ration that is not yet saved.
- The red box and green show the margin for the four rations. You can compare the margin to advice the farmer with the best and healthy ration for his cows.
- While using the same milk price for the wet season, it is evident that the dry season rations calculated with this milk price have low margins.

27. Case study 1: Ration 2, 4 & 5 milk price change

- During the dry season most processors increase the price of milk.
- With better experience, a consultant can help the farmer calculate milk prices against the same rations.
- In this case for the rations fed during the dry season the milk price change increase from Ush.800 to Ush.1000 per liter.
- Notice the change of margins for dry season rations red boxes.

28. Case study 1: Wet and dry season margins

- Remember to always calculate margins with the correct milk prices. If the prices are different in different seasons then it should be noted.
- From the red box you can notice that if prices are better in the dry season than in the wet seasons, the farmer receives better margins.
- Feeding your cow with a healthy balanced diet is the key here, but most farmers might go with the lowest in cost of production. As a consultant, it is your place to advise the farmer properly.

29. Case study 1: Conclusion

- The more the nutritional parameters that you try to satisfy/perfect/balance (minerals, NDF, RDP, UDP, and starch) in your ration, the more expensive it becomes.
- This is because the feed costs will increase and the margin will reduce.

Metabolisable energy	●	NDF (%DM)	44.3 ●	Starch (%DM)	18.7 ●
Supply (MJ)	150	NDF (kg)	6.620	Sugar (%DM)	1.8 ●
Demand (MJ)	150	eNDF (%NDF)	54.1 ●	NFC (%DM)	24.5
Balance (MJ)	0	NDF frg (%NDF)	47.1	Forage : Conc	50:50 ●
Density (MJ/kg DM)	10.0	NDF frg (%lw)	0.62	Ash (%DM)	10.1

Metabolisable protein	●	RDP/UDP protein		Enteric methane	
Supply (g)	1363	RDP (%CP)	65.0 ●	Total (g/cow)	312
Demand (g)	1277	UDP (%CP)	35.0 ●	Intensity (g/L)	15.8
Balance (g)	86	Excess protein forgone			
CP (%DM)	17.0	milk	1.1 - 3.6 L	Fat (%DM)	4.1 ●

DM intake estimate	●	Calcium (g)	●	Phosphorus (g)	●
Max. NDF intake%	102	Supply	290.1	Supply	61.4
Maximum DMI%	95	Demand	73.1	Demand	47.7
DMI as % liveweight	3.0	Balance	217.0	Balance	13.7

Active recommended levels

○ One   ○ Four
○ Two   ○ Five
○ Three   ○ Off

Early Lactation (1-100days)

Magnesium (g)	●	DCAD	●
Supply	35.2	Calculated	-
Demand	27.7	Recommended	>250
Balance	7.5		

30. Case study 1: Save ration for this case

- Save the rations you have calculated using the following steps;
  i. Click 'Files' then click 'Save As with libraries', Rumen8 folder will open in your computer in the documents folder.
  ii. Select the fodder you want to save these rations, in our case we had created a folder called 'Uganda Farms Library'. Open it, then name the ration files 'Case study 1' and click 'Save' to save the rations.
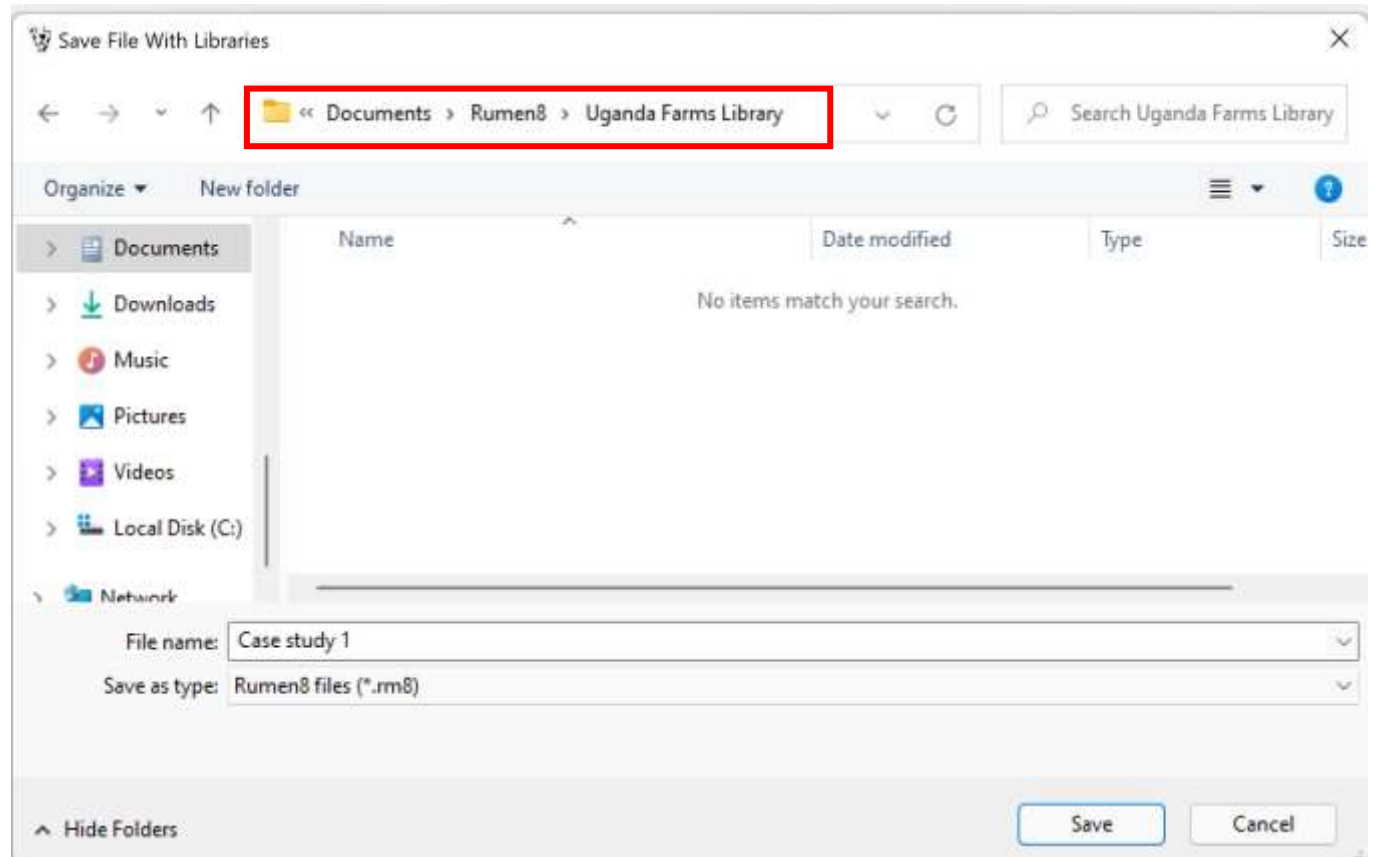
31. Case study 1: Share PDF report

- To print or share a PDF report, click the tab 'File', the 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).

32. Case study 1: PDF report saving and printing

- After clicking create, a report requirement pop-up with links to guide to download a report creating software.
- Follow the link and guidelines with the installation and set up process.
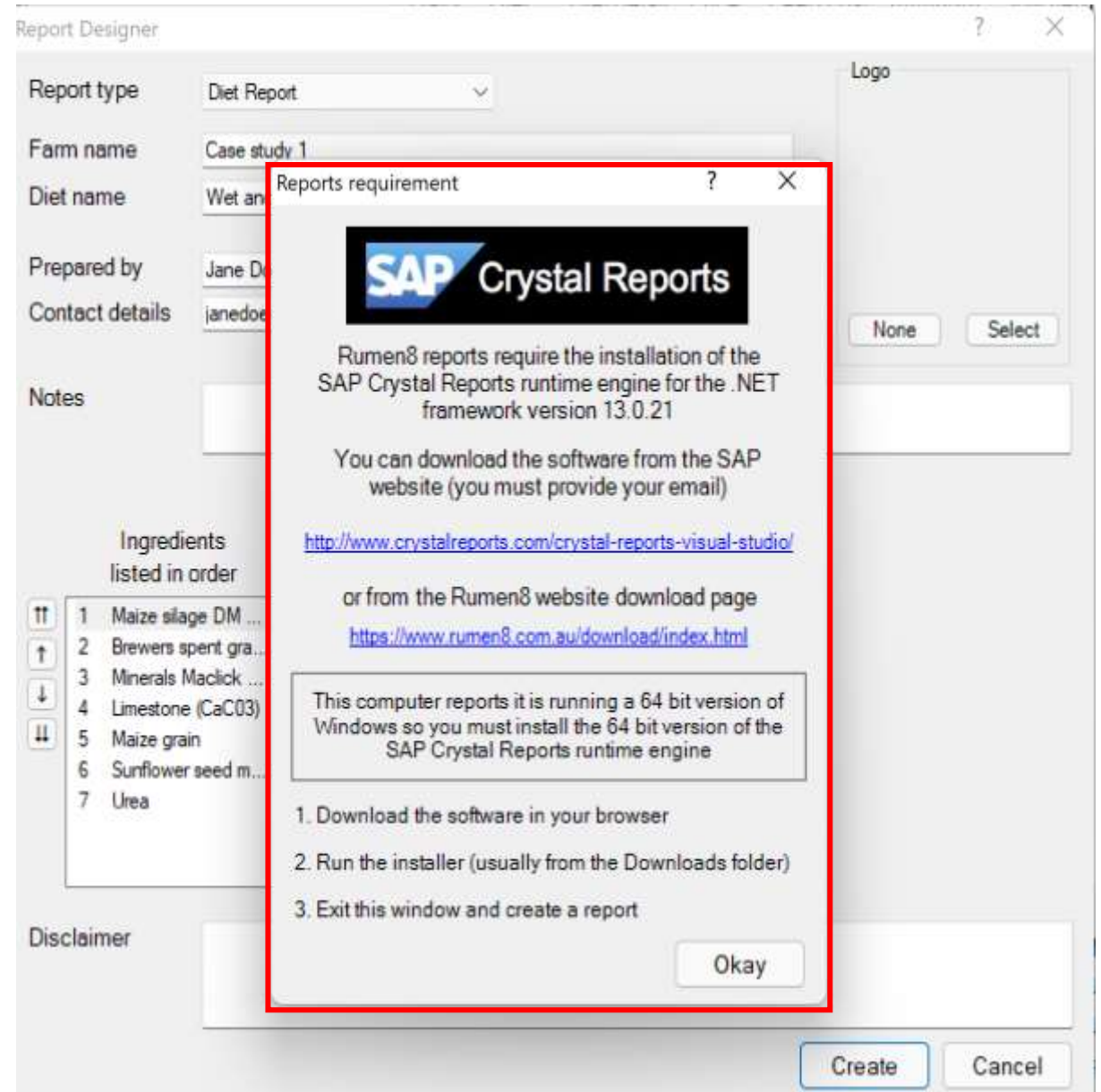
33. Case study 1: Share PDF report

- 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 the report.

- END -