

Rumen8

TRAINING MANUAL

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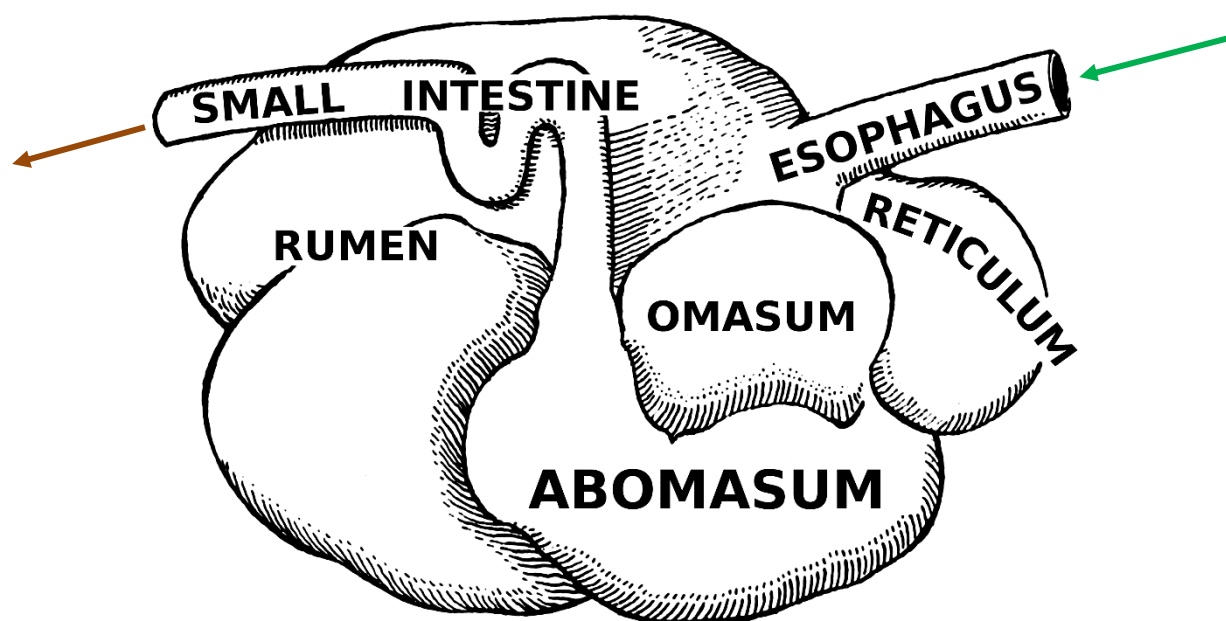
TABLE OF CONTENTS

Table of Contents.....	3
Introduction.....	4
Cow Requirements	5
Introduction	5
Metabolisable energy and energy digestion in the ruminant	5
Case Study 1.1 Rumen8 ration formulation to meet energy requirements	7
Case Study 1.2 Rumen8 ration formulation to meet protein requirements.....	11
Case Study 1.3 Rumen8 ration formulation and fibre requirements	14
Case Study 1.4 Rumen8 ration formulation and intake predictions.....	17
Case Study 1.5 - Achieving a balanced ration..	21
Feed Supply	24
Nutrient content	24
The Feed Library	26
The feed library	26
The feed and mix editor	27
Case Study 2.1 - Selecting feeds and mixes	28
Nutritional information for each feed	29
Case Study 2.2 - Editing and adding Feeds	31
Case Study 2.3 – Adding a feed mix.....	35
Factoring in losses, feed costs and milk price.....	38
Case Study 3.1 Factoring in losses and feed costs	38
Optimising feed profitability.....	42
Case Study 3.2 Entering milk price	42
Case Study 3.3 Comparing diets	44
Conclusion.....	46

INTRODUCTION

Dairy cow nutrition is complex and delivering a ration that is safe, performs well and is cost effective requires a lot of thought. Complex software is available for professional nutritionists to design rations for dairy cows and for many farmers use of these services is a sound business practice. However, it often means that farmers do not have the understanding or confidence to assess and formulate their own rations.

Figure 1. A Schematic diagram of the ruminant digestive system



Whilst professional nutritional advice is expected to be sound, farmers accept recommendations without the ability to interact and discuss these meaningfully with their nutritionist. Having the knowledge and user friendly tools to formulate rations themselves allows farmers to also make decisions that are sound, timely and that come with little cost. Farmers should still involve their nutritionist but have the confidence to discuss the ration with them.

Feed inputs can change on a regular basis and getting the nutritionist out each time is often impractical. Source changes for the same feedstuff could also affect the ration because of changes in nutrient status from one crop to the next. Being able to react to these fluctuations in a timely way is necessary to maintain a consistent daily ration.

Rumen8 is a simple computer based tool that is easy to navigate and interact with to design a dairy cow ration. It factors in the main nutritional parameters giving the user an easy-to-read indication of how the formulated diet meets specified requirements and what the expected return will be based on current or projected milk prices. Whilst the program gives easy to read output it generates this from detailed calculations built in 'behind the scenes'. Although the Rumen8 program is easy to use it does help if farmers know some of the principles of dairy nutrition on which it is based and from which it generates animal responses. This training manual covers these foundation principles. Three main factors will be covered building up skills using Rumen8 as it is presented in the training sessions.

COW REQUIREMENTS

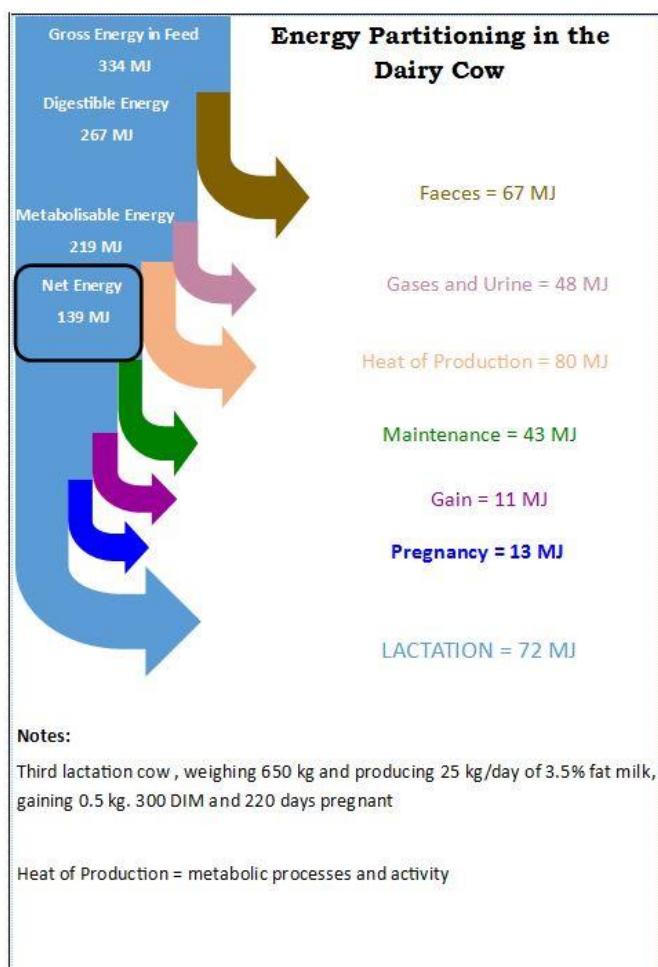
INTRODUCTION

Dairy cows require rations that contain enough nutrients for growth, maintenance, pregnancy, activity, reproduction and milk production. Avoiding excessive amounts of nutrients is important as it could affect cow health, reduce feed conversion efficiency (kg of milk per kg of feed) and reduce margin over feed costs. Underfeeding will impact performance and will impact on cow health and fertility if severe. Cow requirements are assessed on several nutritional factors. Aside from water, which is a critical input, feed inputs and feed requirements are measured in terms of energy, protein, fibre, fat, vitamins and minerals. Factors such as cow age and weight, milk yield, stage of lactation, pregnancy, activity and environmental conditions will all affect feed requirements. Rumen8 allows the user to specify the cow for which the ration is to be designed (see cow detail – case study 1).

METABOLISABLE ENERGY AND ENERGY DIGESTION IN THE RUMINANT

Cows need energy for their different physical functions. The total energy of a feed is measured in a combustion chamber but the amount of energy that a cow can utilise is reduced because of energy losses in manure, urine and gases that are belched out. The energy available for maintenance, live weight gain, pregnancy and lactation is metabolisable energy (ME), but even some of this is lost as heat (see Figure 2).

Figure 2. Energy partition in the ruminant



Metabolisable energy is commonly used to balance rations as this is a reasonably accurate estimate of the energy required by the cow. If insufficient ME is provided in the ration, the cow will divide energy demand to priority metabolic processes and will lose condition. If more than enough ME is provided for maintenance, growth, milk production and reproduction, then the cow will put on condition.

Most of the energy that a cow needs comes from volatile fatty acids (VFAs) that are produced in the rumen through microbial fermentation of feeds. Microbes live in the rumen in huge populations comprising bacteria, fungi and protozoa. They require energy, protein, minerals and vitamins to reproduce and grow. They will digest 70-80% of the feed entering the rumen (that depends on feed quality of course but for a well fed lactating dairy cow 80% is typical) and as they digest feeds in the rumen they produce VFAs that are absorbed across the rumen wall into the blood stream to be used by the cow for cell growth, physical activity, metabolic processes (including milk production) and reproduction.

Different species of microbes digest different feedstuffs with the production of differing amounts and types of the various VFAs. The relative proportion of these VFAs will impact on the composition of milk produced in the udder. The combination of these VFAs, and the saliva produced by the cow, which has a buffering effect, results in a rumen pH of around 6.0 in a healthy cow fed a balanced diet. In addition to the VFAs, microbes will produce lactic acid from certain feeds, particularly those high in starch. Lactic acid is a strong acid that has the potential to increase rumen acidity. Too much lactic acid in the rumen can result in acidosis that will be harmful to the cow. The starch content of the ration and the degradability of the starch is therefore important from an animal health perspective. Guidelines for feeding starch recommend that the ration contain a maximum of 20-25% starch to be safe provided it is fed carefully.

Feeds that escape microbial breakdown in the rumen will be chemically digested to a varying degree in the abomasum and small intestine and absorbed to provide energy, protein, minerals and vitamins for the animal. Undigested feed passes out of the animal with the manure.

CASE STUDY 1.1 RUMEN8 RATION FORMULATION TO MEET ENERGY REQUIREMENTS

Cow Detail – setting cow parameters in Rumen8

Cow details can be entered in a couple of ways. The top menu on Rumen8 has five tabs. 'File', 'Edit', 'Animal', 'View' and 'Help'. Clicking on the 'Animal' tab will bring up options for you to select. The information selected here interacts with the cow information under the 'Animal' tab on the right of the main window. You can create your own default cow data and this can be accessed whenever you want. You can enter the cow details for a particular ration formulation directly under the 'Animal' tab on the main ribbon.

Exercise 1: You are planning a ration for the following cow:

- 600 kg live weight
- Gaining 0.3kg/day
- Producing 24 litres/day
- Milk fat - 3.8%
- Protein - 3.4%
- 200 days in milk
- 120 days pregnant
- Walking around 3 km/day on a flat farm

Enter her details under the 'Animal' tab on the main window as per Figure 3.

Figure 3. Describing the cow to be fed on the 'Animal' tab.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients

	DM	As Fed
1. None	0.00	0.00
2. None	0.00	0.00
3. None	0.00	0.00
4. None	0.00	0.00
5. None	0.00	0.00
6. None	0.00	0.00
7. None	0.00	0.00
8. None	0.00	0.00
9. None	0.00	0.00
10. None	0.00	0.00
11. None	0.00	0.00
12. None	0.00	0.00
13. None	0.00	0.00
14. None	0.00	0.00
15. None	0.00	0.00

0.0 0.0

Animal Diet Diet detail Milk price Feed cost Compare Notes

Breed: Holstein

Live weight (kg): 600

Live weight change (kg/d): 0.3

Days pregnant: 31

Days in milk: 31

Number of cows in herd: 1

Milk yield (L/d): 24.0

Milk fat (% m/v): 3.8

Milk true protein (% m/v): 3.4

Fat:Protein ratio: 1.12

Fat, Protein, F+P (kg/d): 0.91 0.82 1.73

Energy corrected: 0.95 0.78 1.74

Cow Activity

Farm terrain: ☒ Flat ☐ Undulating ☐ Steep

Distance walked (km/d): 3.0

Feed costs

\$/tonne	-
c/MJ ME	-
\$/kg CP	-
\$/cow/day	-

Milk income

\$/L raw milk	-
\$/kg ECM	-
\$/kg MS	-
\$/cow/day	-

Feed efficiency

Kg ECM/kg DM	-
Gm MS/kg DM	-
\$Milk/\$Feed	-

Margin

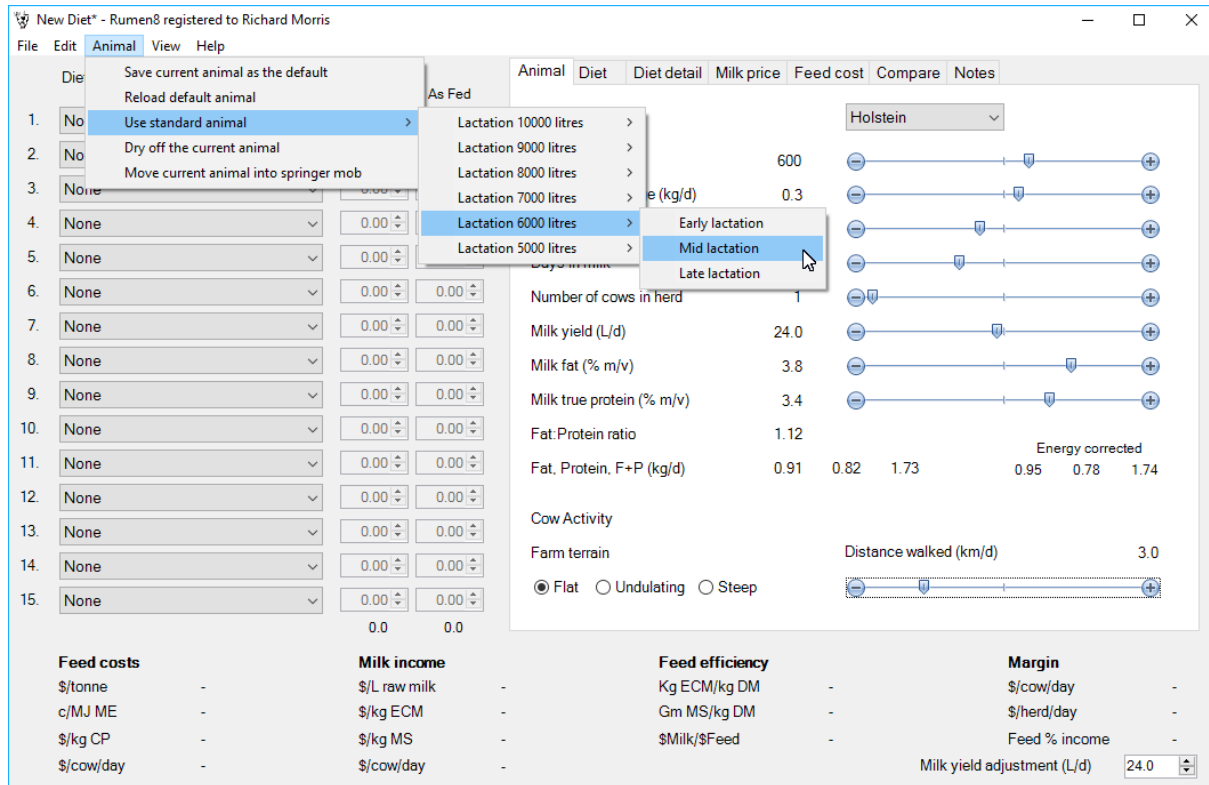
\$/cow/day	-
\$/herd/day	-
Feed % income	-

Milk yield adjustment (L/d): 24.0

Using default cow details

Rumen8 has default values for cows at different stages of lactation producing 5,000 to 10,000 litres which can be loaded and then edited to match your cow of interest for a particular ration formulation.

Figure 4. Using the 'standard' cows to quickly set the animal details.



Exercise 2: Using standard cows - refer to Figure 4

1. Click on the 'Animal' tab on the main window so you can see the cow details
2. Click on the 'Animal' menu on the top left hand of the main window
3. Click on 'Use standard animal' submenu
4. Click on 'Lactation 6000 litres' submenu
5. Click on 'Mid lactation' submenu
6. See how the details change in the 'Animal' tab
7. Click on 'Use standard animal' menu
8. Click on 'Lactation 7000 litres submenu
9. Click on 'Mid lactation' submenu
10. See how the details change in the 'Animal' tab

Diet Detail – formulating a ration for energy requirements

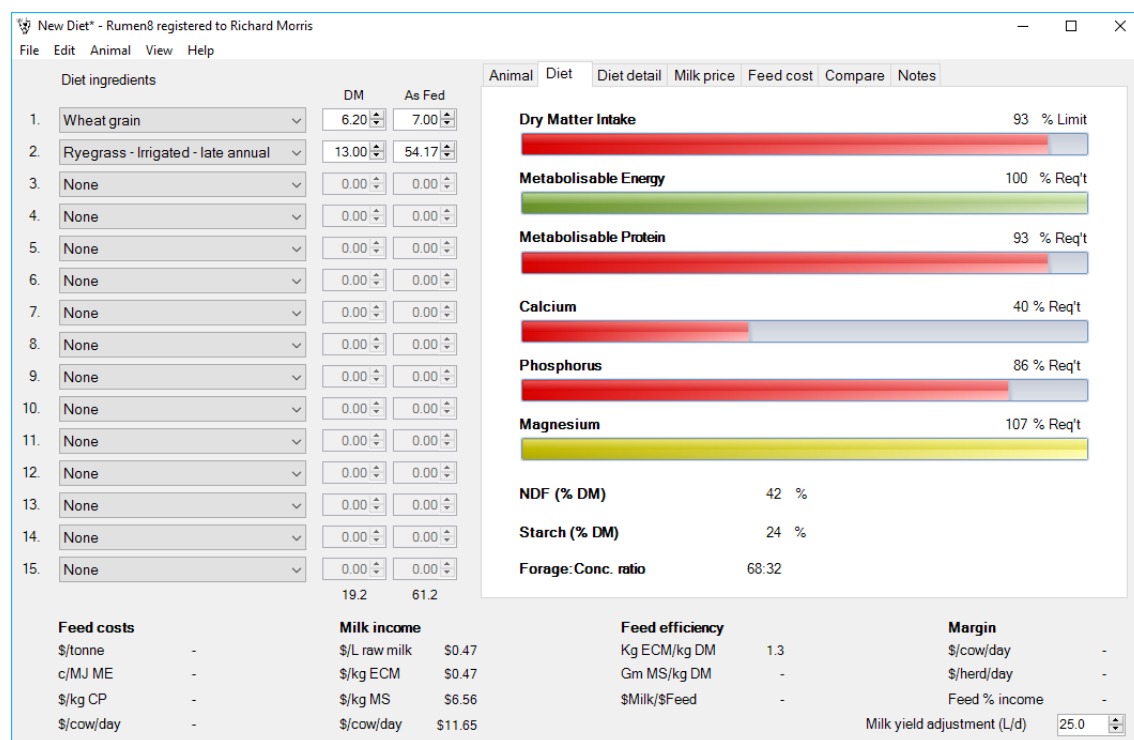
Exercise 3: Formulating a ration to meet energy requirements

1. Use the 7000-litre late lactation cow described for Exercise 1
2. In the 'Diet Ingredients' section of the main window there are 15 boxes to enter up to 15 feeds
3. In Box 1, select 'Wheat grain'
4. Enter 7.00 (kg/day) in the 'As Fed' column
Feeds can be fed on a dry matter (DM) basis or on a 'as fed' (wet or fresh) basis. Concentrates are commonly entered on an as fed basis and forages and fodder on a DM basis
5. In Box 2, select 'Ryegrass – Dryland – late annual'
6. Enter 13 (kg/day) in the 'DM' column

The 'Diet' Tab

In the 'Diet' tab note how the progress bars move as diets and amounts being fed are entered. This gives a quick overview of how the diet is shaping up to meet cow requirements. The top three bars are targets to aim for to ensure a balanced ration. The bottom three percentages are levels to watch to ensure that the diet is safe. There are many factors that affect the safety of a ration. When it comes to guidelines for safe diets consultation with a nutritionist is advisable as high starch diets can be dangerous. It is best to err on the side of caution. Starch levels should not exceed 18-22% in the total ration. So-called NDF (neutral detergent fibre; discussed further on page 13) levels need to be in the 32-36% range to achieve high yields. NDF levels should not be below 30% and ideally not exceed 40% as they will impact negatively on dry matter intake.

Figure 5. The Diet tab showing how well the diet of wheat grain and pasture is performing.



Comments:

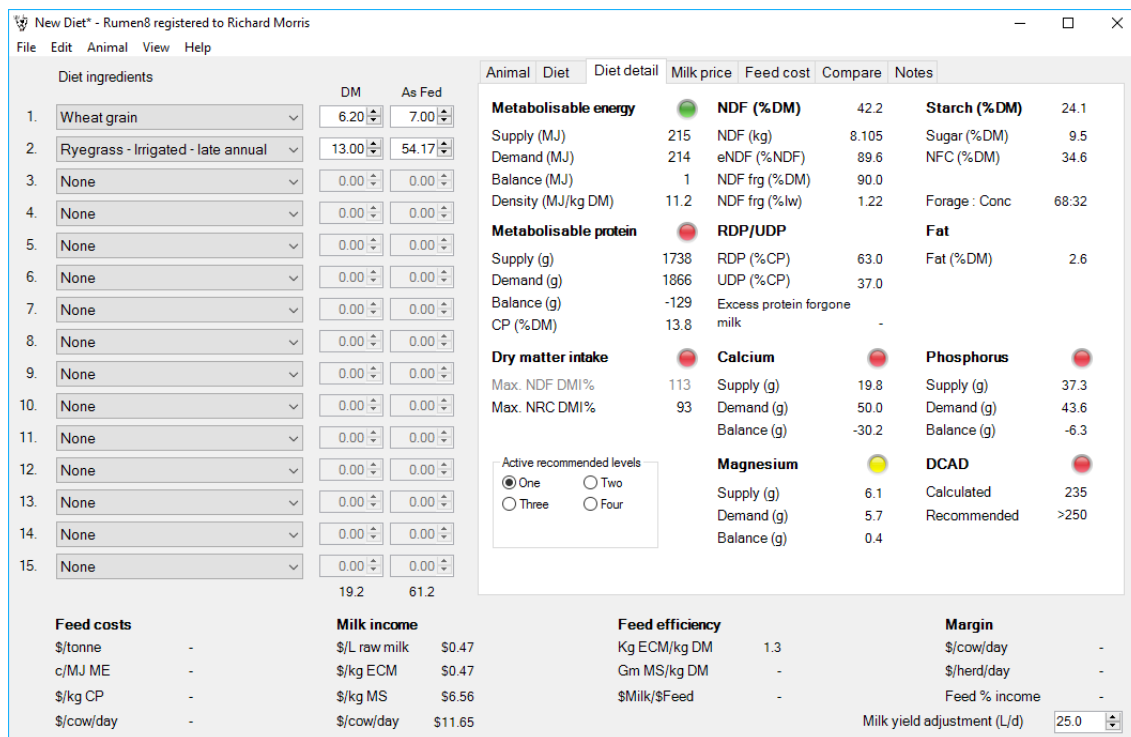
The ration above (Figure 5) consists of wheat and pasture, and meets the cow's requirements for energy but other needs have not been addressed, e.g. metabolisable protein (MP) intake. Wheat has been selected as it is a high energy content feed but the starch content of the ration is up at the maximum amount recommended for a dairy cow.

With the 'Diet' tab on view click on the number of the diet component and details of the feed chosen will be displayed. Alternatively select 'Ingredient detail' in the 'View' menu or hover the mouse pointer over the ingredient name to display a tooltip window with the details.

The 'Diet Detail' Tab

The 'Diet' tab is a good visual indicator of how well the ration meets cow requirements but it is a simple overview. The 'Diet Detail' tab gives the specifications of the ration in greater detail and should be used to check the suitability of the ration (refer Figure 6).

Figure 6. The Diet detail tab showing more detailed measures of how well the diet is performing.



CASE STUDY 1.2 RUMEN8 RATION FORMULATION TO MEET PROTEIN REQUIREMENTS

Metabolisable Protein and Protein breakdown in the Ruminant

Proteins make up the crucial structure of the body cells of all living organisms. Animals need protein to survive, grow, produce and reproduce. Animals synthesize their protein requirements from basic building blocks called amino acids (AA) that are absorbed from protein digested in feeds. Protein in feed is broken down in the stomach and small intestine to AA that are then absorbed from the digestive tract for protein synthesis by the animal. In monogastrics (animals with a single stomach such as pigs and humans), the food eaten goes directly to the stomach and small intestine for digestion. Not all AA can be synthesised by the body and so some must be supplied in feed and these are known as essential AA. Other AA that can be synthesised by the animal itself from simple molecules are known as non-essential AA.

In the ruminant, feed eaten goes into the rumen where microbes use most of it for themselves in the process of fermentation (anaerobic 'digestion'). Some will pass through to the abomasum and small intestine for chemical digestion. The rumen microbes will synthesise their own protein as living organisms using the building blocks from fermenting feed proteins and non-protein nitrogen sources (such as urea). A main product of protein fermentation is ammonia which is then used to synthesize microbial AA and proteins. The other main class of products of rumen fermentation are the volatile fatty acids (VFA) which provide energy to the ruminant (discussed earlier on page 6).

As the digesta pass from the rumen they include billions of microbes and these microbes are digested chemically in the abomasum and small intestine to yield AA that are then absorbed and used to build the animal's protein. These digested microbes together with feed that has escaped microbial digestion in the rumen supply all the AA needed by the cow to make her own protein. Very high producing cows may require additional specific AA to be supplied in the diet, AA such as lysine and methionine which can be lacking at high production levels on certain diets.

Modern ration formulation systems for ruminants are based on metabolisable protein as this provides a more accurate measure of protein needs than the older systems which were based on crude protein (CP). Rumen8 is based on metabolisable protein.

Diet Detail – formulating a ration for protein requirements

Exercise 4: Formulating a ration to meet protein requirements

1. Under the 'Diet Ingredients', change 'Wheat grain' to 'Lupins grain'
2. Change the amount of 'Lupins grain' to 4.2 kg/day
3. Leave the amount of 'Ryegrass – Dryland – late annual' unchanged.

Figure 7. The Diet tab showing the new diet with Lupins grain included.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients			DM	As Fed
1.	Lupins grain		3.76	4.20
2.	Ryegrass - Irrigated - late annual		13.00	54.17
3.	None		0.00	0.00
4.	None		0.00	0.00
5.	None		0.00	0.00
6.	None		0.00	0.00
7.	None		0.00	0.00
8.	None		0.00	0.00
9.	None		0.00	0.00
10.	None		0.00	0.00
11.	None		0.00	0.00
12.	None		0.00	0.00
13.	None		0.00	0.00
14.	None		0.00	0.00
15.	None		0.00	0.00
			16.8	58.4

Animal	Diet	Diet detail	Milk price	Feed cost	Compare	Notes
Metabolisable energy ● NDF (%DM) 49.3 Starch (%DM) 3.6 Supply (MJ) 185 NDF (kg) 8.268 Sugar (%DM) 11.3 Demand (MJ) 214 eNDF (%NDF) 88.6 NFC (%DM) 20.3 Balance (MJ) -29 NDF frg (%DM) 88.2 Density (MJ/kg DM) 11.0 NDF frg (%lw) 1.22 Forage : Conc 78:22 Metabolisable protein ● RDP/UDP Fat Supply (g) 1868 RDP (%CP) 68.1 Fat (%DM) 3.8 Demand (g) 1866 UDP (%CP) 31.9 Balance (g) 2 Excess protein forgone milk 0.7 - 2.5 L CP (%DM) 18.8 Dry matter intake ● Calcium ● Phosphorus ● Max. NDF DMI% 115 Supply (g) 23.4 Supply (g) 30.3 Max. NRC DMI% 81 Demand (g) 50.0 Demand (g) 41.1 Balance (g) -26.6 Balance (g) -10.9 Active recommended levels <input checked="" type="radio"/> One <input type="radio"/> Two <input type="radio"/> Three <input type="radio"/> Four Magnesium ● DCAD ● Supply (g) 6.2 Calculated 281 Demand (g) 5.7 Recommended >250 Balance (g) 0.5						
Feed costs Milk income Feed efficiency Margin \$/tonne - \$/L raw milk \$0.47 Kg ECM/kg DM 1.5 \$/cow/day - c/MJ ME - \$/kg ECM \$0.47 Gm MS/kg DM - \$/herd/day - \$/kg CP - \$/kg MS \$6.56 \$Milk/\$Feed - Feed % income - \$/cow/day - \$/cow/day \$11.65 Milk yield adjustment (L/d) 25.0						

Comments:

Note the low starch content in the ration above (

Figure 7). Lupin grain has been selected to provide the cow's MP needs as it is high in CP. Lupin digestion in the rumen also supplies VFA for energy. The above ration meets the cow's protein requirements but doesn't address other important requirements such as intake, ME, and starch. Not only must both energy and protein be provided in a balanced ration to meet the cow's needs but adequate fibre is also needed so as not to adversely affect cow health.

CASE STUDY 1.3 RUMEN8 RATION FORMULATION AND FIBRE REQUIREMENTS

Neutral Detergent Fibre and Fibre Digestion in the Ruminant

Ruminants can eat and utilise forages and in fact would not survive without forage in the diet. Forages are characterised by their high fibre content relative to concentrate feeds such as grain, protein meals and some by-product feeds. It is the fibre in the ration that maintains a healthy microbial population in the rumen. The microbial digestion of feed fibre in the rumen is a very important factor. The fibre component of a forage consists of compounds that range from readily digestible to indigestible. The amount of fibre and the relative proportion of digestible to indigestible fibre determines the quality of the forage as a feed source. There are different chemical assays that are used to describe the fibre fraction of a feed. The most common is Neutral Detergent Fibre (NDF) which is a measure of the level and digestibility of fibre in a feed.

Lush ryegrass pastures will have a lower NDF than more mature later-season ryegrasses. Good quality silages and hays generally have a higher NDF content than well managed grazed pastures. Poor quality silages and hays have the highest NDF content. Concentrates have the lowest NDF content.

Rumen microbes readily utilise the digestible portions of fibrous feeds for their requirements and in the process, provide energy and protein for the cow. The cow's ability to regurgitate forage (chewing their cud) and re-chew it, mix it with fresh saliva and re-swallow it, allows the animal to process forage feeds more efficiently. This process is called rumination and animals with this ability are thus called ruminants. Saliva is an important part of the digestive process as it is alkaline and as stated earlier, acts as a buffer for rumen pH, helping to maintain rumen pH in the healthy range.

Too little NDF in the diet will adversely affect rumen health, caused by rumen acidosis which reduces production and can cause cows to die in severe cases. On the other hand, too much NDF in the diet results in a slowly digestible diet and reduced feed intake with a consequent low supply of ME, resulting in low levels of production. Therefore, it is essential to offer the correct amount of NDF in the diet to achieve high milk yields and good cow health.

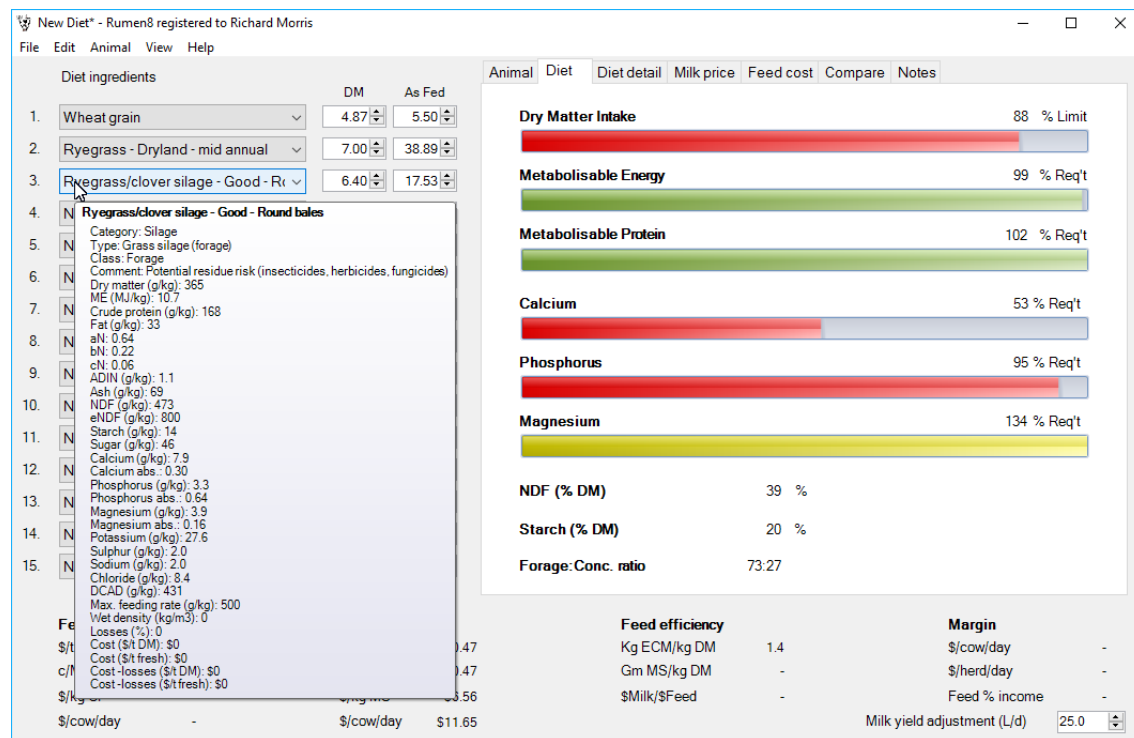
Recommendations around NDF levels suggest a ration NDF of 30-32% in early lactation and 32-36% in later lactation. Rumen8 calculates the NDF percentage in the ration, and this should be considered when formulating rations.

Diet Detail – formulating a ration focusing on a good quality forage with a lower NDF

Exercise 5: Formulating a ration with a lower NDF

1. Create a ration using the feeds and amounts as shown in Figure 8

Figure 8. The Diet tab showing the ingredients in the NDF case study diet.



Comments:

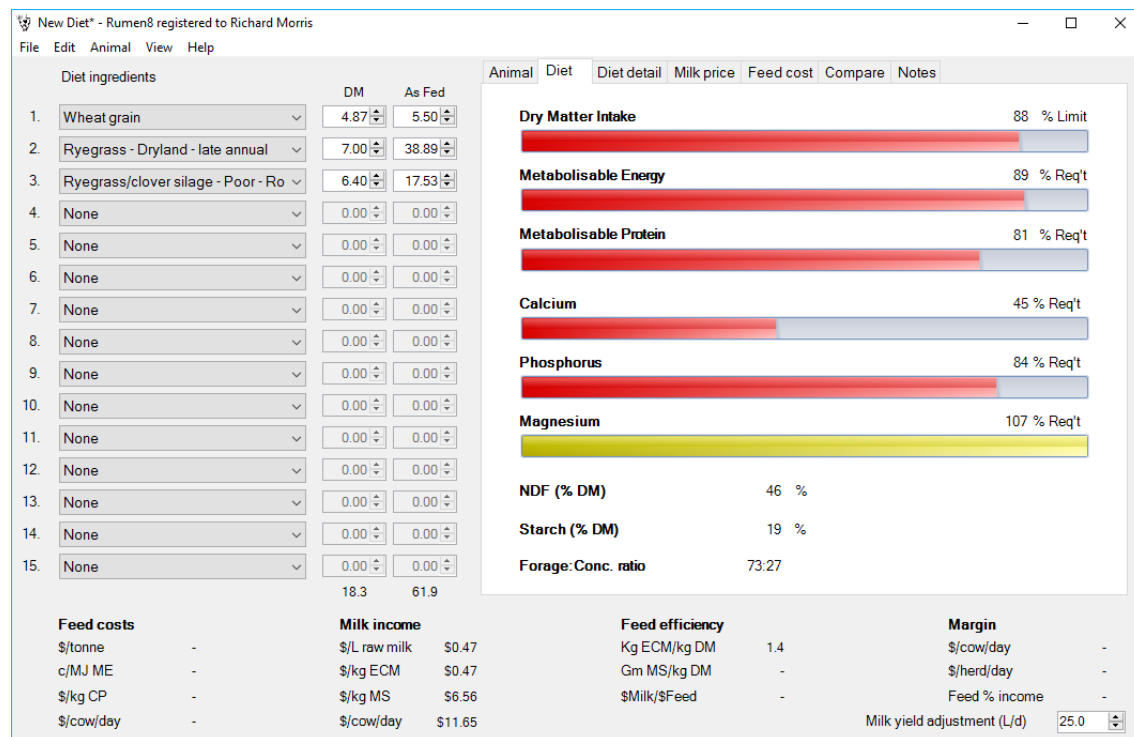
This ration (Figure 8) is balanced for energy (ME) and protein (MP). The ration NDF is at the upper end of recommended levels, especially for cows in early lactation and some further refinements could be made. The ration starch level is adequate so a little cereal grain could be added but that may reduce metabolisable protein supply.

Diet Detail – formulating a ration focusing on poor quality forage with higher NDF

Exercise 6: Formulating a ration with a higher NDF

1. Using the Exercise 5 above, leave the amounts fed the same for the concentrate
2. Change 'Ryegrass – Dryland – mid annual' to 'Ryegrass – Dryland – late annual'
3. Change 'Ryegrass/clover silage – Good - Rolls' to 'Ryegrass/clover silage – Poor - Rolls'

Figure 9. The Diet tab showing the impact of poor quality forage late in the season.



Comments:

In Figure 9 you can see that by keeping the concentrate and pasture allocations the same, but feeding poorer quality pasture and silage, the ration falls short of energy and protein requirements. The overall ration NDF level has increased and even though the intake is the same as for good quality forage, there could be some impact on DM intake (DMI) that is not reflected in this ration because of the higher NDF.

CASE STUDY 1.4 RUMEN8 RATION FORMULATION AND INTAKE PREDICTIONS

Dry Matter Intake

Knowing how much a cow can eat in a day is important in formulating rations. Predicting DM intake is complex because of the many factors that influence intake, such as the cow, the ration and the environment. Rumen8 reports how the actual DMI, as entered in the diet components, compares to the maximum DMI as predicted by the so called NDF and NRC equations. Generally, we suggest that the NRC intake equation is more reliable and thus preferred, but sometimes keeping an eye on intake predicted by the NDF equation can be helpful.

Diet Detail – DMI predictions for a ration with a lower NDF

Exercise 7: Formulating a ration with a lower NDF and its impact on dry DM intake

1. Create the ration as shown in Figure 10 below
2. Note the ration specifications under the 'Diet Detail' tab

Figure 10. The Diet detail tab showing the DMI prediction case study diet.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients

	DM	As Fed
1. Wheat grain	3.10	3.50
2. Ryegrass - Dryland - mid annual	7.00	38.89
3. Ryegrass/clover silage - Good - R	8.00	21.92
4. None	0.00	0.00
5. None	0.00	0.00
6. None	0.00	0.00
7. None	0.00	0.00
8. None	0.00	0.00
9. None	0.00	0.00
10. None	0.00	0.00
11. None	0.00	0.00
12. None	0.00	0.00
13. None	0.00	0.00
14. None	0.00	0.00
15. None	0.00	0.00
Total	18.1	64.3

Feed costs

\$/tonne	-
c/MJ ME	-
\$/kg CP	-
\$/cow/day	-

Milk income

\$/L raw milk	\$0.47
\$/kg ECM	\$0.47
\$/kg MS	\$6.56
\$/cow/day	\$11.65

Feed efficiency

Kg ECM/kg DM	1.4
Gm MS/kg DM	-
\$Milk/\$Feed	-

Margin

\$/cow/day	-
\$/herd/day	-
Feed % income	-
Milk yield adjustment (L/d)	25.0

Animal Diet Diet detail Milk price Feed cost Compare Notes

Metabolisable energy

Supply (MJ)	204
Demand (MJ)	213
Balance (MJ)	-9
Density (MJ/kg DM)	11.3

Metabolisable protein

Supply (g)	1911
Demand (g)	1866
Balance (g)	45
CP (%DM)	17.0

Dry matter intake

Max. NDF DMI%	106
Max. NRC DMI%	87

NDF (%DM)

NDF (kg)	7.634
eNDF (%NDF)	84.3
NDF frg (%DM)	94.7
NDF frg (%lw)	1.20

Starch (%DM)

Sugar (%DM)	8.2
NFC (%DM)	30.9
Forage : Conc	83:17

RDP/UDP

RDP (%CP)	70.7
UDP (%CP)	29.3
Excess protein forgone milk	0.1 - 0.5 L

Calcium

Supply (g)	29.5
Demand (g)	50.0
Balance (g)	-20.5

Phosphorus

Supply (g)	39.0
Demand (g)	42.5
Balance (g)	-3.4

Magnesium

Supply (g)	8.2
Demand (g)	5.7
Balance (g)	2.5

DCAD

Calculated	356
Recommended	>250

Active recommended levels

☒ One ☐ Two ☐ Three ☐ Four

Comments:

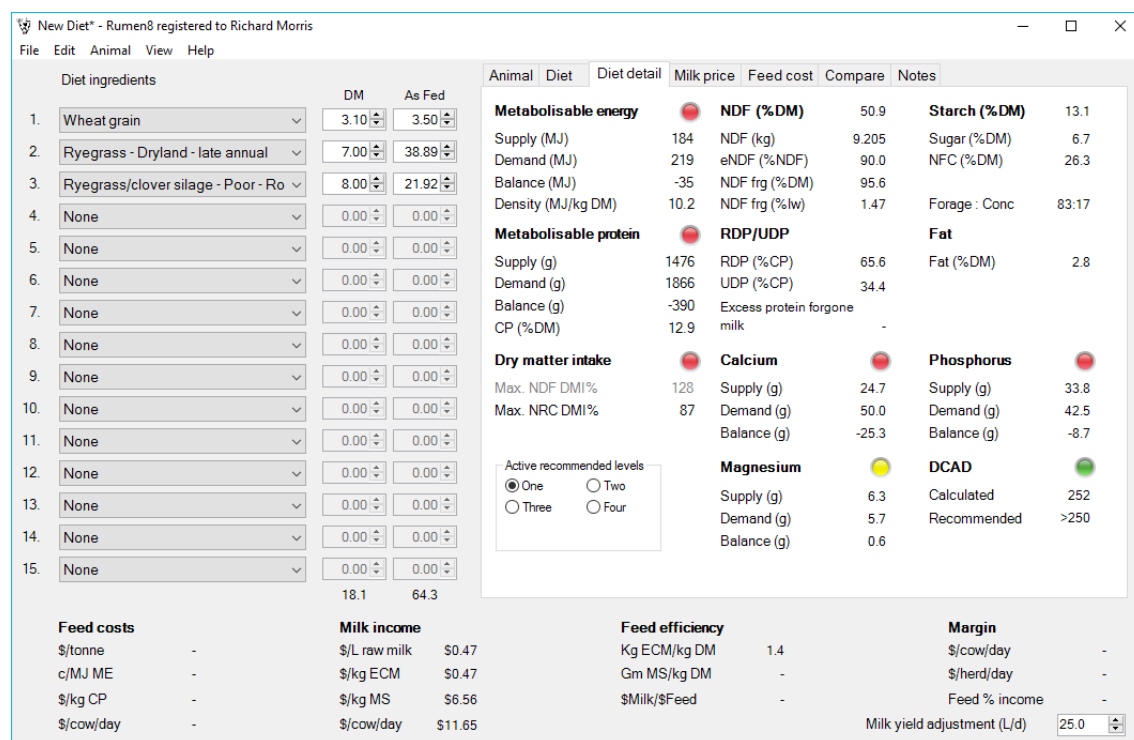
Refer to Figure 10. When you click on the 'Diet Detail' tab on the main window you will see under the DM column that you are feeding 18.1 kg DM/cow/day. Can she physically eat this amount? The 'Max NDF DMI%' is 106% which suggests that the cow might not eat all the feed on offer. The 'Max NRC DMI%' is 87% which suggests she could eat more. It is better to be guided by the NRC figure where the ration consists of concentrates and forages. More of the ration could be fed and depending on the stage of lactation the extra feed could see more milk being produced and/or an improved live weight gain.

Diet Detail – DMI predictions for a ration with a higher NDF

Exercise 8: Formulating a ration with a higher NDF and its impact on DM intake

1. Keep the amounts of feed being fed the same
2. Change 'Ryegrass – Dryland – mid annual' to 'Ryegrass – Dryland – late annual'
3. Change 'Ryegrass/clover silage – Good - Rolls' to 'Ryegrass/clover silage – Poor - Rolls'
4. Note the changes under the "Diet Detail" tab

Figure 11. The Diet detail tab showing the DMI prediction for the case study diet.



Comments:

Note (Figure 11) that based on the NDF model, the DMI has now exceeded maximum intake by 28% for the higher NDF ration. The lower quality silage is limiting DMI even more than the good quality silage. However, the NRC predicted DMI is the same at 87% of maximum intake. Theoretically the cow in question will cope with the ration and suggests that the DMI could be increased based on the NRC prediction. The ration is now deficient in energy and protein and so will not sustain the 25 litre yield of the cow in question. There is room to increase the wheat and lupin content of the diet and so provide more energy and protein.

Exercise 9: Increasing the level of concentrates in a higher NDF ration whilst ensuring that the DMI of the ration can be achieved

1. Change the amount of wheat and/or add lupins to achieve a more balanced ration
2. Observe the DMI parameters under the 'Diet Detail' tab








Other Nutrient Requirements

Cows also have daily requirements for minerals that are necessary for function and production. Rumen8 reports on the main minerals calcium, phosphorus and magnesium under the 'Diet' and 'Diet Detail' tabs. It is recommended that a nutritionist be consulted around these components as well as other ration components such as trace elements.

The Traffic Lights in Rumen8

Under the 'Diet Detail' tab there are traffic lights that help to give a visual picture of the formulated diet. They are useful as a **guide** to how effectively the ration being formulated is meeting ME, MP and DM requirements.

Figure 12. The three traffic lights on the Diet detail tab for energy, protein and intake.

Animal	Diet	Diet detail	Milk price	Feed cost	Compare	Notes
			Metabolisable energy		NDF (%DM)	38.9
					Starch (%DM)	19.7
			Supply (MJ)	210	NDF (kg)	7.109
			Demand (MJ)	212	eNDF (%NDF)	82.8
			Balance (MJ)	-2	NDF frg (%DM)	91.0
			Density (MJ/kg DM)	11.5	NDF frg (%lw)	1.08
					Forage : Conc	73:27
			Metabolisable protein		RDP/UDP	
			Supply (g)	1903	RDP (%CP)	70.5
			Demand (g)	1866	UDP (%CP)	29.5
			Balance (g)	36	Excess protein forgone	
			CP (%DM)	16.6	milk 0.1 - 0.4 L	
			Dry matter intake		Calcium	
			Max. NDF DMI %	99	Supply (g)	26.4
			Max. NRC DMI %	88	Demand (g)	50.0
					Balance (g)	-23.6
					Phosphorus	
					Supply (g)	40.4
					Demand (g)	42.6
					Balance (g)	-2.3
					Magnesium	
					Supply (g)	7.6
					Demand (g)	5.7
					Balance (g)	1.9
					DCAD	
					Calculated	317
					Recommended	>250

Active recommended levels

☒ One ☐ Two

☐ Three ☐ Four

Referring to Figure 12, the top traffic light indicates the status of the metabolisable energy provided by the ration. The middle light indicates the status of the metabolisable protein provided by the ration and the lights on the bottom rows indicate the status of the dry matter intake and minerals of the ration.

A **RED** light indicates that the ration is not supplying a sufficient level of energy or protein or that the maximum DMI has not been reached. The ration should be changed to ensure that enough energy and protein is supplied. Where this is the case, but DMI is not at maximum, the ration should be right to feed. Where this is the case, but DMI exceeds the maximum, we have to ask ourselves if this ration is in fact realistic as it may not be able to be fully consumed.

A **YELLOW** light indicates an oversupply of energy or protein or that the maximum DMI has been exceeded. If the maximum DMI has been exceeded, then there is the likelihood that the cow will not be able to eat all the ration and may not have her energy and protein needs met at an intake she can cope with. Manipulating the diet component intake levels will bring the ration more in line with requirements at an intake level the cow can cope with and give more certainty that the ration is the right one.

A **GREEN** light indicates that the ration is supplying the energy and protein needed and/or that the cow should be able to consume all the daily ration DM.

Manipulating the diet components to achieve green lights is the objective. However, it can be alright for the DMI light to be red if the lights for energy and protein are green. It is important to be practical with the ration formulation and to watch the actual amounts of energy and protein being supplied. The sensitivity of the traffic lights can be changed in the Rumen8 preferences. The default setting is +/- 2%.

CASE STUDY 1.5-ACHIEVING A BALANCED RATION


Exercise 10: You are formulating a ration to provide enough nutrients for a 600 kg cow producing 28 litres/day of milk testing at 3.8% fat and 3.2% protein. She is 180 days in milk and 100 days pregnant. She walks 4.5 km/day on a flat farm. She is gaining 0.2 kg/day in weight.


You can choose whatever foodstuffs you think you have available.

The feed test (Figure 13) is for annual ryegrass sampled on the 6th August 2015 from a paddock ready for grazing at the Vasse Research Centre near Busselton WA.

Figure 14 has the feed test data for annual tetraploid ryegrass sampled on the 15th July 2015 on a dairy property near Brunswick WA.

Figure 13. Example feed analysis report 1.





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FEED ANALYSIS REPORT

Western Dairy 113 Armstrong Rd Tutunup WA 6280	ATTENTION FAX NUMBER PURCHASE ORDER PROJECT NUMBER	Tammy Negus Credit Card J1508-0307
--	---	--

DATE RECEIVED	11 August 2015
OUR SAMPLE NUMBER	S2015-21164
YOUR REFERENCE	Weldon Vasse Pasture
SAMPLE TYPE	Pasture Fresh
DESCRIPTION	
DATE SAMPLE COLLECTED	08 August 2015

TEST	Result
NIR Package (NA)	
Dry Matter (%)	12.4
Moisture (%)	87.6
Crude Protein (% of dry matter)	28.6
Acid Detergent Fibre (% of dry matter)	24.4
Neutral Detergent Fibre (% of dry matter)	47.7
Digestibility (DMD) (% of dry matter)	76.4
Digestibility (DOMD) (Calculated) (% of dry matter)	71.6
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.5

Note: This report is not to be reproduced except in full.


Final Report


Report Number: 140884

Comments:


Metabolisable Energy has been calculated using the following equation:
 ME = (0.203 x DOMD%) - 3.001

Figure 14. Example feed analysis report 2.





Under license from AVS



Accredited for compliance with ISO/IEC 17025

FEED ANALYSIS REPORT

Western Dairy PO Box 5066 Bunbury WA 6230	ATTENTION FAX NUMBER	Rob La Grange
	PURCHASE ORDER PROJECT NUMBER	Credit Card J1507-0659

DATE RECEIVED	17 July 2015
OUR SAMPLE NUMBER	S2015-19109
YOUR REFERENCE	Fry Shed
SAMPLE TYPE	Pasture Fresh
DESCRIPTION	
DATE SAMPLE COLLECTED	15 July 2015

TEST	Result
NIR Package (NA) ^	
Dry Matter (%)	10.4
Moisture (%)	89.6
Crude Protein (% of dry matter)	31.5
Acid Detergent Fibre (% of dry matter)	17.3
Neutral Detergent Fibre (% of dry matter)	42.6
Digestibility (DMD) (% of dry matter)	83.8
Digestibility (DOMD) (Calculated) (% of dry matter)	77.8
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	12.8
Chloride (TP/192) ^	
Chloride. (% of dry matter)	1.60
Dietary Cation-Anion Difference (TP/016) ^	
DCAD ((Na+K)-(Cl+S)) (meq/kg)	539
Metals - ICP (TP/293)	
Calcium (mg/kg of dry matter)	3600
Potassium (mg/kg of dry matter)	39000
Magnesium (mg/kg of dry matter)	2700
Sodium (mg/kg of dry matter)	5900
Phosphorus (mg/kg of dry matter)	3500
Sulphur (mg/kg of dry matter)	3800

Note: This report is not to be reproduced except in full.

^ - NATA Accreditation does not cover the performance of this test.

Final Report

Report Number: 139560

Comments:

Metabolisable Energy has been calculated using the following equation:
 ME = (0.203 x DOMD%) - 3.001

FEED SUPPLY

NUTRIENT CONTENT

Introduction

Ruminant feeds vary considerably with respect to concentrations of nutrients such as energy, protein and fibre. Ruminant feeds can be broadly classified as concentrates and fodder/forages.

Fodder/forages vary in metabolisable energy and crude protein content depending on the plant species/variety and stage of growth. They tend to have higher NDF levels than concentrates. Generally, the higher the NDF content, the lower the ME and CP content. The ME content of a fodder or forage depends largely on the digestibility of the feed, which affects the availability of its nutrients for use by the animal. Fodder/forages are essential for healthy rumen function but fed alone will generally result in lower milk yields even where the quality of the fodder/forage is high. In the case of good quality fodder/forage fed alone, intake limits milk production mostly through so-called rumen-fill factors.

Concentrates contain high levels of ME and/or CP per kg DM. They are relatively low in NDF, but there are exceptions. While concentrates make the perfect feed for monogastrics such as pigs and chickens, in ruminants, including dairy cows, concentrates fed by themselves will negatively impact on rumen health and therefore animal health. However, when fed in a balanced ration in combination with forages, concentrates generally result in higher milk yields than what can be achieved by feeding forages alone.

Ruminant nutrition is more than energy alone

When it comes to ration formulation, the feeds used in the diet are described with respect to the nutrients they supply. Dairy cow diets can be formulated using basic parameters such as ME and CP but this lacks the detail required to ensure that the ration is balanced for nutrients to optimise profitability. The ME content of a feed is enough information for a ration to be formulated to ensure adequate energy supply, but the ME content alone gives no detail as to the source of the energy in a feed. Structural carbohydrates (NDF), non-structural carbohydrates (including starch and sugar), fats/oils, as well as proteins are all sources of energy. The non-structural carbohydrates are rapidly broken down in the rumen and will lower rumen pH to levels that can impact adversely on the animal health.

Rumen8 not only provides information on the supply of ME to the cow, but also gives information on the NDF, starch, sugar and fat levels in the diet (as well as detailed information on protein supply; see below), to assist the user to ensure that these are within recommendations.

Metabolisable protein

When it comes to formulation of dairy cow diets for protein, the simple CP content of a feed does not adequately describe its feed value. Rumen8 calculates the metabolisable protein supply from a diet. The MP content of a feed cannot be measured in a laboratory, as it depends on several factors that change with every diet. These factors are all considered in Rumen8.

The first factor affecting the MP supply of ruminants is the CP content of the feed, which can be measured in the lab. Crude protein is made up of all organic compounds in a feed which contain nitrogen. It ranges from the true proteins (compounds containing amino acids) in grass, wheat and canola meal etc., through to the non-protein nitrogens found in fertiliser urea but also many common feeds including grass and silage.

The second factor affecting the MP supply of ruminants is the rumen degradability of feed protein. Feeds eaten by a ruminant undergo fermentation in the rumen. Much of the feed CP is broken down by the rumen bugs to ammonia which is then used by them to grow and multiply. These bugs are high in CP themselves

and are constantly washed out of the rumen with the digesta flow. As soon as they enter the abomasum (true stomach) they are digested and the products of digestion are then absorbed in the small intestine. This process provides most the MP needed by the cow.

Some feed protein does not get degraded in the rumen and flows into the abomasum where it will undergo digestion and then on to the small intestine for absorption. This makes up the remainder of the MP supply to the dairy cow.

The proportion of feed protein that escapes ('bypasses') breakdown in the rumen varies with the feed type and any treatments that may have been applied (e.g. heating or ensiling), but also depends greatly on how much feed is fed. This is the third factor that affects the MP supply of ruminants: the level of total feed intake. At a low intake level, feed spends longer in the rumen and more of the protein is broken down so less escapes from the rumen. In contrast, at a high intake level, the protein spends less time in the rumen and therefore less is broken down and more escapes breakdown. This is called the 'rate of passage' of the feed through the rumen.

Rumen8 calculates the supply of and demand for MP considering these factors, which vary with every diet formulated. This is why the MP content of a feed cannot be measured in the lab, unlike its ME content.

The rumen degradability of feed CP is measured with the nylon bag method using rumen-fistulated cows. This method is available only at specialised research centres and is not available at feed analysis labs. The degradability of feed CP is expressed with 3 measurements, the aN, bN and cN values or a, b, c values for short. The 'a' value describes the immediately available portion of feed CP, the 'b' value described the potentially rumen degradable portion of the feed CP, while the c value describes how quickly the 'b' fraction can be broken down in the rumen (%/hour).

Mineral content of feeds

It is also important to know the minerals supplied by a ration so that adjustments for deficiencies can be made. Rumen8 calculates the supply and demand of calcium, phosphorus and magnesium in the diet, but this relies on accurate information on the mineral content for **all** the feeds in the ration. Feed laboratories or plant test labs can measure the calcium, phosphorus and magnesium and other mineral content of feeds.

THE FEED LIBRARY

On opening the main Rumen8 window, the left section has fifteen boxes where feeds and mixes can be selected to form the ration. Which feeds and mixes are listed and the details of these feeds and mixes can be specified in the Feed library.

THE FEED LIBRARY

The feed editor is entered by clicking on the 'Edit' menu on the top left corner of the window and then selecting 'Edit Feeds'.

Figure 15. To change anything about a feed or mix go to the feed editor.

The screenshot shows the 'New Diet' window in Rumen8. The 'Edit' menu is open, and 'Edit feeds' is selected. The interface includes a list of 15 feed slots, each with a dropdown menu currently set to 'None'. To the right of these slots are columns for 'DM' and 'As Fed' values, all showing '0.00'. The right side of the window displays various nutritional requirements and limits, such as 'Dry Matter Intake' (Limit), 'Metabolisable Energy' (Req't), 'Metabolisable Protein' (Req't), 'Calcium' (Req't), 'Phosphorus' (Req't), and 'Magnesium' (Req't). At the bottom, there are sections for 'Feed costs', 'Milk income', 'Feed efficiency', and 'Margin', each with associated units and values. A 'Milk yield adjustment (L/d)' slider is set to 25.0.

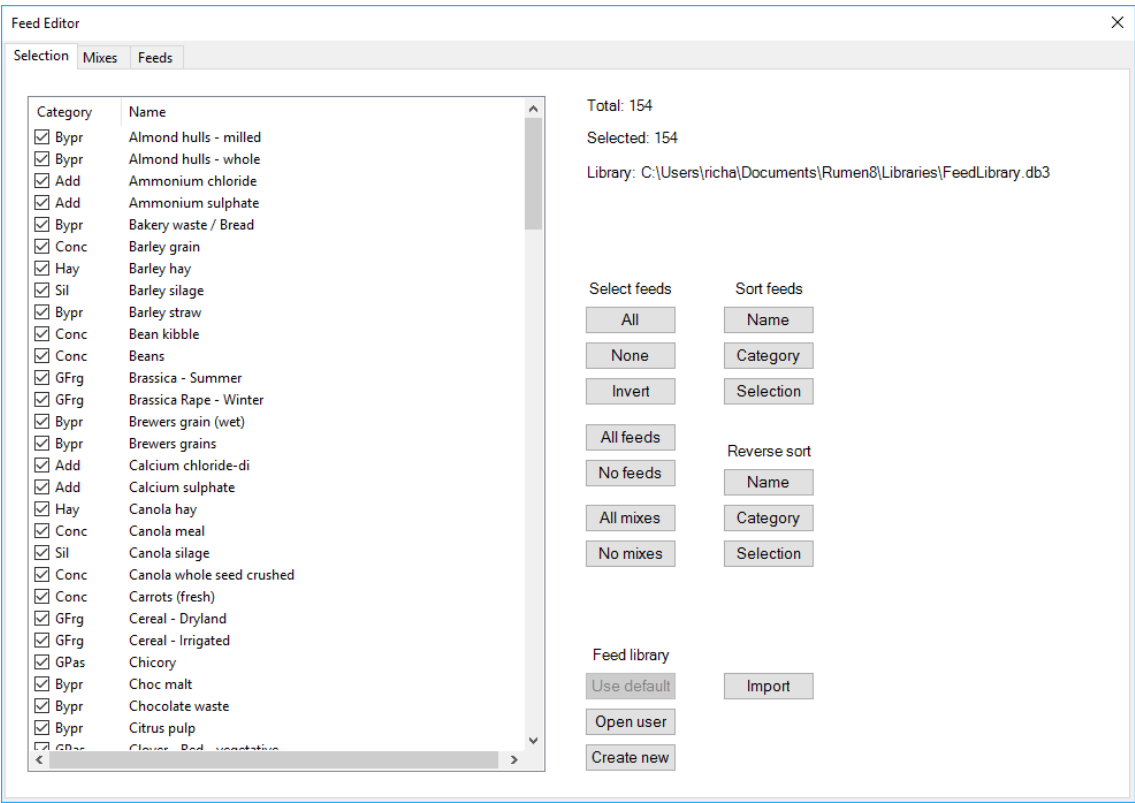
Feed Slot	DM	As Fed
1.	0.00	0.00
2.	0.00	0.00
3.	0.00	0.00
4.	0.00	0.00
5.	0.00	0.00
6.	0.00	0.00
7.	0.00	0.00
8.	0.00	0.00
9.	0.00	0.00
10.	0.00	0.00
11.	0.00	0.00
12.	0.00	0.00
13.	0.00	0.00
14.	0.00	0.00
15.	0.00	0.00

Feed costs	Milk income	Feed efficiency	Margin
\$/tonne	\$/L raw milk	Kg ECM/kg DM	\$/cow/day
c/MJ ME	\$/kg ECM	Gm MS/kg DM	\$/herd/day
\$/kg CP	\$/kg MS	\$Milk/\$Feed	Feed % income
\$/cow/day	\$/cow/day		

Milk yield adjustment (L/d): 25.0

THE FEED AND MIX EDITOR

Figure 16. The Selection tab of the Feed Editor.

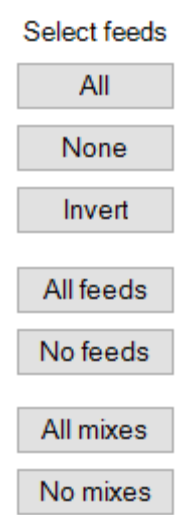


Selecting the feeds for the ration

The total number of feeds in the library is shown on the top right of the listed feeds as well as the number of feeds that have been selected to be visible in the diet ingredients drop-down lists. Feeds that are never used on your farm can be 'unchecked' so that they don't show in the ingredients drop-down lists. Beneath the feed numbers is shown the path of the current feed library. This will usually be the Rumen8\Libraries folder in your Documents folder but you can have multiple feed libraries in different locations.

The buttons below the total number and selected number of feeds are feed selection buttons.

Figure 17. The feed and mix selection buttons.



The **'All'** button selects all the listed feeds and mixes to be visible in the ingredients drop-down lists. The **'None'** button clears all the listed feeds. The **'Invert'** button reverses the current selection so selected feeds are de-selected and unselected feeds are selected. The buttons below these allow you to select all or none of just feeds or just mixes.

Beside the selection buttons are sort buttons that allow you to change if the feeds and mixes are sorted by name, management category or if they are selected or not. Reverse sort sorts Z-A instead of A-Z.

CASE STUDY 2.1 - SELECTING FEEDS AND MIXES

Individual feeds or mixes are selected by checking the little boxes on the left side of the listed feed

To select just the feeds and mixes you plan to use on your farm check the box for those feeds. The number of feeds selected is displayed on the right of the list. Selected feeds are then visible in the diet ingredients drop-down lists of the main Rumen8 window.

Exercise 11: Using the selection buttons.

- Click 'Invert' and note how the list changes from selected to deselected
- Click the 'All' button - note all the listed feeds and mixes are selected
- Click 'None' - all listed feeds and mixes are deselected

Exercise 12: Selecting feeds to formulate a ration.

Uncheck all feed boxes.

The ration you plan to feed will make use of some or all the following feeds that are available:

- Wheat grain
- Lupins grain
- Average quality ryegrass/clover hay
- Good quality ryegrass/clover silage
- Mid-season annual ryegrass pastures

Select these feeds in the library

Click on the close button 'X' in the top right of the window to return the Rumen8 main window.

1. Use the cow already loaded on the main 'Animal' tab
2. Select three of the feeds in the first three diet component boxes and enter the amounts of the individual feed to be fed daily. Remember to check the 'Wet' box if the feed is fed on a wet basis
3. Check the ration

NUTRITIONAL INFORMATION FOR EACH FEED

Click on the 'Feeds' tab in the Feed Editor to see all the nutritional information for each feed.

Figure 18. The Feeds tab of the Feed Editor.

The screenshot shows the 'Feed Editor' window with the 'Feeds' tab selected. On the left is a list of feeds with columns for 'Category' and 'Name'. On the right is the 'Edit' form for a selected feed, 'Almond hulls - milled'. The form contains three sections: '1. Feed management category', '2. Feed protein type', and '3. Feed particle size classification'. Below these are various nutritional parameters with input fields. Parameters in bold (ME, CP, DM, Fat, aN, bN, cN) are required. At the bottom, there are 'Okay' and 'Cancel' buttons.

Category	Name
Bypr	Almond hulls - milled
Bypr	Almond hulls - whole
Add	Ammonium chloride
Add	Ammonium sulphate
Bypr	Bakery waste / Bread
Conc	Barley grain
Hay	Barley hay
Sil	Barley silage
Bypr	Barley straw
Conc	Bean kibble
Conc	Beans
GFRg	Brassica - Summer
GFRg	Brassica Rape - Winter
Bypr	Brewers grain (wet)
Bypr	Brewers grains
Add	Calcium chloride-di
Add	Calcium sulphate
Hay	Canola hay
Conc	Canola meal
Sil	Canola silage
Conc	Canola whole seed crushed
Conc	Carrots (fresh)
GFRg	Cereal - Dryland
GFRg	Cereal - Irrigated
GPas	Chicory
Bypr	Choc malt
Bypr	Chocolate waste
Bypr	Citrus pulp
GPas	Clover - Red - vegetative

Edit

Name: Almond hulls - milled

1. Feed management category

☐ Grazed pasture ☐ Grazed other ☐ Hay ☐ Silage

☐ Concentrate ☐ Additive ☒ Byproduct

2. Feed protein type

☐ Grass silage ☒ Other non-forage

☐ OtherSilage ☐ Other forage ☐ Distillery byproduct

3. Feed particle size classification

☒ Concentrate ☐ Forage ☐ Other

ME (MJ/kg) 9.0 aN 0.30 Starch (g/Kg) 20

CP (g/Kg) 52 bN 0.35 Sugar (g/Kg) 283

DM (g/Kg) 877 cN 0.05 Ash (g/Kg) 78

Fat (g/Kg) 30 ADIN (g/Kg) 2.7 NDF (g/Kg) 354

Ca (g/Kg) 2.8 Ca abspn 0.60 eNDF in NDF 340

P (g/Kg) 1.2 P abspn 0.70 Cost (\$/t DM)

Mg (g/Kg) 1.2 Mg abspn 0.16 Cost (\$/t fed)

K (g/Kg) 27.6 Max feeding rate (g/Kg) 150 Losses (%) 0

Na (g/Kg) 0.2 Wet density (kg/m3) 300 Cost +losses \$

Cl (g/Kg) 0.5 Source Cost +loss. fr \$

S (g/Kg) 0.6 Comment Feed value varies according to proportion

DCAD (MEq) 663

Required feed parameter names are in bold
All units are on a DM basis unless shown otherwise

Okay Cancel

When you highlight a feed on the list in the Edit Feed page the nutritional information for that feed is displayed. The parameters that are in bold are the minimum required parameters that need to be entered for Rumen8 to function. As a minimum, eleven parameters are required for a feed to be accepted as valid and their names are in bold in the edit section. These are a unique name, management category, protein type, particle size classification, ME, CP, DM, Fat, aN, bN and cN. Until valid values for these parameters are entered you will be unable to save the feed.

If you are unsure what the parameters refer to, hover your mouse over the name and a tooltip will appear with the full name and an explanation. Abbreviations are also listed at the end of this document.

IMPORTANT

Given the importance of the correct management category, protein type and particle size classification of a feed, and the difficulty in obtaining aN, bN, cN and ADIN values for feeds, we strongly suggest you ALWAYS create a new feed in your feed library by adding a copy of a closely matching existing feed from the original Rumen8 feed library, which can then be modified for DM, ME, CP, fat and other feed values. For this reason we also suggest you NEVER edit feeds in the original Rumen8 feed library, but add copies of these feeds instead which can then be modified to reflect your feeds.

Although Rumen8 can function with just these required parameters, to make full use of the features of the program, all feed values should be entered if possible. Entering feed costs and keeping these up to date is also important if you wish to compare diets to determine the lowest cost option.

As the aN, bN, cN and ADIN values are not easily obtained, a generic list is provided here that indicates typical values for different feed classes (AFRC 1993).

Table 1. Typical protein degradability (aN, bN and cN) and ADIN (g/kg DM) values for different feed classes.

Feed class	aN	bN	cN	ADIN
Fresh forages	0.24	0.67	0.12	1.2
Roots	0.25	0.65	0.41	1.2
Grass and legume silages	0.59	0.31	0.13	1.2
Cereal silage incl maize	0.69	0.20	0.10	2.2
Grass hays	0.22	0.60	0.08	1.2
Legume hays	0.20	0.65	0.29	2.0
Cereal straws	0.30	0.50	0.12	1.0
Cereals	0.47	0.48	0.27	0.4
Legume seeds	0.41	0.57	0.16	0.5
Cereal byproducts	0.36	0.55	0.09	1.0
Beet and citrus pulps	0.39	0.57	0.05	1.2
Oils meals, high fibre	0.24	0.69	0.11	3.3
Oil meals, low fibre	0.14	0.79	0.09	2.1

Editing, deleting and adding new feeds

The Edit Feeds page allows the user to edit any of the listed feeds and to add new feeds.

Figure 19. The Feeds tab of the Feed Editor showing the parameters for Barley grain and the editing buttons.

The screenshot shows the 'Feed Editor' window with the 'Feeds' tab selected. On the left, a list of feeds is shown, with 'Barley grain' (Conc) highlighted. On the right, the 'Edit' form for 'Barley grain' is displayed. The form includes fields for Name, Feed category (Concentrate, Additive, Byproduct), Feed protein type (Grass silage, Other non-forage, OtherSilage, Other forage, Distillery byproduct), Feed particle size classification (Concentrate, Forage, Other), and various nutrient parameters: ME (MJ/kg), CP (g/Kg), DM (g/Kg), Fat (g/Kg), Ca (g/Kg), P (g/Kg), Mg (g/Kg), K (g/Kg), Na (g/Kg), Cl (g/Kg), S (g/Kg), DCAD (MEq), aN, bN, cN, ADIN (g/Kg), Starch (g/Kg), Sugar (g/Kg), Ash (g/Kg), NDF (g/Kg), eNDF in NDF, Cost (\$/t DM), Cost (\$/t fed), Losses (%), Cost +losses, Cost +loss. fr, Source, and Comment. Buttons for Edit, Add Copy, Add New, and Delete are visible. A tooltip 'Edit the selected feed' is shown over the 'Edit' button.

The four buttons on the right of the feed list engage with the actual feeds.

Figure 20. The Feeds tab editing buttons.



CASE STUDY 2.2 - EDITING AND ADDING FEEDS

Delete Button

This allows the selected feed in the feed list to be deleted from the library.

Edit Button

This allows existing feeds in the library to be edited if necessary. As mentioned before we strongly recommend AGAINST using this option.

Add Copy Button

This allows for a feed to be selected and then duplicated so that changes can be made to the feed but keeping the original unchanged. The added copy is then renamed as needed.

Exercise 13: You have purchased a load of lupin grain and sent it off for a test. The test results come back and you want to enter it in the feed library.

1. Select Lupins grain in the feed list
2. Click 'Add Copy' button

The feed will now appear in the feed edit box to the right and will be named 'Lupins grain (copy)'

3. Type in a unique name for the copied feed e.g. 'Lupins grain tested August 2015'
4. Make any changes to its nutrition specs as required
5. Click 'Okay' to accept the new feed

This function is useful where you have submitted a feed for analysis that is already in the library such as silage, hay and pasture and of course grains

Figure 21. Adding a copy of the existing Lupins grain feed to the feed library.

The screenshot shows the 'Feed Editor' interface with three tabs: 'Selection', 'Mixes', and 'Feeds'. The 'Selection' tab is active, displaying a list of feed items categorized by 'Conc', 'Add', 'Bypr', 'GFr', 'Hay', 'Sil', 'GFr', 'Conc', 'Bypr', 'GFr', 'GPa', and 'GPa'. The 'Lupins grain' feed is selected. To the right of the list are buttons for 'Edit', 'Add Copy', 'Add New', and 'Delete'. The 'Edit' button is highlighted, and the 'Edit' dialog box is open. The dialog box has a 'Name' field containing 'Lupins grain (Copy)'. It contains three sections: '1. Feed management category' with radio buttons for 'Grazed pasture', 'Grazed other', 'Hay', 'Silage', 'Concentrate' (selected), 'Additive', and 'Byproduct'; '2. Feed protein type' with radio buttons for 'Grass silage', 'Other non-forage' (selected), 'Other silage', 'Other forage', and 'Distillery byproduct'; and '3. Feed particle size classification' with radio buttons for 'Concentrate' (selected), 'Forage', and 'Other'. Below these sections are input fields for various feed parameters: ME (MJ/kg) 13.8, CP (g/Kg) 345, DM (g/Kg) 896, Fat (g/Kg) 71, Ca (g/Kg) 2.6, P (g/Kg) 3.6, Mg (g/Kg) 2.3, K (g/Kg) 8.9, Na (g/Kg) 0.4, Cl (g/Kg) 0.5, S (g/Kg) 2.3, DCAD (MEq) 83, aN 0.36, bN 0.60, cN 0.18, ADIN (g/Kg) 1.3, Ca abspn 0.60, P abspn 0.70, Mg abspn 0.16, Max feeding rate (g/Kg) 250, Wet density (kg/m3) 790, Source, and Comment. On the right side of the dialog box are input fields for Starch (g/Kg) 31, Sugar (g/Kg) 77, Ash (g/Kg) 34, NDF (g/Kg) 259, eNDF in NDF 269, Cost (\$/t DM), Cost (\$/t fed), Losses (%), Cost + losses, and Cost + loss. fr. At the bottom of the dialog box are 'Okay' and 'Cancel' buttons. A note at the bottom states: 'Required feed parameter names are in bold. All units are on a DM basis unless shown otherwise.'

Add New Button

If for some rare reason you have a feed which does not have a similar feed in the feed library, and as a result you are not able to copy and edit an existing feed, you will need to create a new feed 'from scratch' in the library. It is important that all essential parameters are entered as accurately as possible (the old adage – 'garbage in = garbage out').

Exercise 14: You have managed to source some dry peas and the nutritional information is as follows.

Table 2. Nutritional analysis of dry peas.

Dry Peas	
ME	13.5 MJ /kg DM
CP	252 g/kg DM
DM	870 g/kg DM
NDF	116 g/kg DM
eNDF	86 ¹ g/kg NDF
Starch	440 g/kg DM
Sugar	25 g/kg DM
Fat	14 g/kg DM
aN	0.56
bN	0.44
cN	0.09

1. Click the 'Add New' button

The edit box below is ready for data to be entered as shown in Figure 22

Figure 22. Adding a new feed. All the required parameters are highlighted red showing they must have values before the feed can be added to the library.

1. Name the feed 'Dry peas'
2. Click on 'Concentrate' for management category
Note that 'Feed protein type' selects 'Other non-forage' and 'Feed particle size classification' selects 'Concentrate' automatically as these are the only valid options.
3. Click 'Okay' to store the feed in the library

Note: To use this feed now that it is in the library you need make sure it is checked in the feed and mix list on the Select tab of the feed editor. Now it will be available as diet ingredient on the main page.

Figure 23. The finished feed entry for dry peas ready to be added to the feed library.

Feed Editor

SelectionMixesFeeds

Category	Name
GFr	Millet
Hay	Millet hay
Sil	Millet silage
Add	Minerals
Conc	Molasses (cane)
Add	Monosodium phosphate
Hay	Oat & vetch hay
Sil	Oat & vetch silage
Bypr	Oat hulls
Hay	Oaten hay
Sil	Oaten silage
Bypr	Oaten straw
GFr	Oats - early vegetative
GFr	Oats - late vegetative
Conc	Oats grain
Bypr	Palm kernel meal (PKE)
GPas	Paspalum - early vegetative
GPas	Paspalum - late vegetative
Hay	Pea hay
Bypr	Pea pollard
Bypr	Peanut shells
Conc	Peas
Conc	Pellets
GPas	Plantain
Bypr	Potato by-products
Conc	Potatoes (fresh)
Bypr	Rice bran
Bypr	Rice hulls
Bypr	Rice pollard

Edit
Add Copy
Add New
Delete

Edit

NameDry peas

1. Feed management category
☐ Grazed pasture
☐ Grazed other
☐ Hay
☐ Silage
☒ Concentrate
☐ Additive
☐ Byproduct

2. Feed protein type
☐ Grass silage
☒ Other non-forage
☐ OtherSilage
☐ Other forage
☐ Distillery byproduct

3. Feed particle size classification
☒ Concentrate
☐ Forage
☐ Other

ME (MJ/kg)	13.5	aN	0.56	Starch (g/Kg)	440
CP (g/Kg)	252	bN	0.44	Sugar (g/Kg)	25
DM (g/Kg)	870	cN	0.09	Ash (g/Kg)	
Fat (g/Kg)	14	ADIN (g/Kg)		NDF (g/Kg)	116
Ca (g/Kg)		Ca abspn		eNDF in NDF	86
P (g/Kg)		P abspn		Cost (\$/t DM)	
Mg (g/Kg)		Mg abspn		Cost (\$/t fed)	
K (g/Kg)		Max feeding rate (g/Kg)		Losses (%)	
Na (g/Kg)		Wet density (kg/m3)		Cost +losses	-
Cl (g/Kg)		Source		Cost +loss. fr	-
S (g/Kg)		Comment			
DCAD (MEq)					

Required feed parameter names are in bold
All units are on a DM basis unless shown otherwise

OkayCancel

Confirm changes and re

CASE STUDY 2.3—ADDING A FEED MIX

Rumen8 allows you to create a feed mix in the feed editor. A mix is a group of feeds that are fed as a single ingredient in the main Rumen8 window. The mix can only contain feeds in the feed library and each feed must be given a percentage of the mix on a dry weight basis.

Click on the 'Mixes' tab of the feed editor to add, edit and delete mixes.

Figure 24. The 'Mixes' tab of the feed library.

The screenshot shows the 'Feed Editor' window with the 'Mixes' tab selected. On the left, there is a list of mixes with 'Mix Demo' selected. Above this list are buttons for 'Edit', 'Add New', 'Add Copy', and 'Delete'. The main area displays the 'Edit' dialog box for 'Mix Demo'. This dialog contains a table of feed components, a list of feed categories on the right, and various input fields at the bottom.

Percent	Feed
10.0	Barley grain
55.0	Lupins grain
35.0	Wheat grain

Total: 100.0

Name

Max feeding rate (g/Kg) Cost (\$/t) DM Fresh

Wet density (kg/m3) Losses (%)

Source

Comment

Category **Name**

- Bypr Almond hulls - milled
- Bypr Almond hulls - whole
- Add Ammonium chloride
- Add Ammonium sulphate
- Bypr Bakery waste / Bread
- Hay Barley hay
- Sil Barley silage
- Bypr Barley straw
- Conc Bean kibble
- Conc Beans
- GFrq Brassica - Summer
- GFrq Brassica Rape - Winter
- Bypr Brewers grain (wet)
- Bypr Brewers grains
- Add Calcium chloride-di
- Add Calcium sulphate
- Hay Canola hay
- Conc Canola meal
- Sil Canola silage
- Conc Canola whole seed crushed
- Conc Carrots (fresh)
- GFrq Cereal - Dryland
- GFrq Cereal - Irrigated
- GPas Chicory
- Bypr Choc malt
- Bypr Chocolate waste
- Bypr Citrus pulp
- GPas Clover - Red - vegetative
- Hay Clover hay

The mixes tab works in a similar way to the 'Feeds' tab in that you can edit, add a new mix, add a copy of the selected mix, and delete the selected mix.

Figure 25. The mix editing section of the 'Mixes' tab in the feed library.

Percent	Feed
10.0	Barley grain
55.0	Lupins grain
35.0	Wheat grain

Total: 100.0

Name:

Max feeding rate (g/Kg): Cost (\$/t): DM: ☐ Fresh: ☐

Wet density (kg/m3): Losses (%):

Source:

Comment:

Category	Name
Bypr	Almond hulls - milled
Bypr	Almond hulls - whole
Add	Ammonium chloride
Add	Ammonium sulphate
Bypr	Bakery waste / Bread
Hay	Barley hay
Sil	Barley silage
Bypr	Barley straw
Conc	Bean kibble
Conc	Beans
GFRg	Brassica - Summer
GFRg	Brassica Rape - Winter
Bypr	Brewers grain (wet)
Bypr	Brewers grains
Add	Calcium chloride-di
Add	Calcium sulphate
Hay	Canola hay
Conc	Canola meal
Sil	Canola silage
Conc	Canola whole seed crushed
Conc	Carrots (fresh)
GFRg	Cereal - Dryland
GFRg	Cereal - Irrigated
GPas	Chicory
Bypr	Choc malt
Bypr	Chocolate waste
Bypr	Citrus pulp
GPas	Clover - Red - vegetative
Hay	Clover hay

The mix editor has three sections.

In the top left is the list of feeds in the current mix and the percentage by dry weight of each of them. The feed percentages must equal 100% before you will be able to exit the mix editor and save the mix.

In the bottom left are the mix parameters that cannot be calculated from the constituent feeds. Here you must give the mix a unique name and can specify other values such as cost and losses.

Mixes must have a name that is unique amongst feeds **and** mixes. You cannot give a mix the same name as a feed or a feed the same name as a mix.

On the left side of the mix editor is the list of feeds that can be added to the mix.

Exercise 15: Rumen8 comes with a 'Mix Demo' mix. Select that in the list of mixes on the left of the 'Mixes' tab and click on the 'Edit' button.

1. Double-click on the 55% cell of the Lupins grain in the mix and change it to 45%. Press the return or enter key to make the change.
Notice the total percentage of the mix goes red and changes to 90% at the bottom of the list. The 10% in brackets is the amount remaining to be added to the mix
2. Select 'Canola meal' in the feed list and then click on the left arrow button (<) to move it into the mix as shown in

3. Figure 26

Figure 26. Adding Canola meal to the current mix.

Feed Editor

Selection Mixes Feeds

Edit Add New

Add Copy Delete

Mix Demo

Percent	Feed
10.0	Barley grain
45	Lupins grain
35.0	Wheat grain

Total: 90.0 (10.0)

Name: Mix Demo

Max feeding rate (g/Kg): Cost (\$/t): DM: Fresh:

Wet density (kg/m3): Losses (%):

Source:

Comment:

Okay Cancel

Category	Name
Bypr	Almond hulls - milled
Bypr	Almond hulls - whole
Add	Ammonium chloride
Add	Ammonium sulphate
Bypr	Bakery waste / Bread
Hay	Barley hay
Sil	Barley silage
Conc	Beans
GFrq	Brassica - Summer
GFrq	Brassica Rape - Winter
Bypr	Brewers grain (wet)
Bypr	Brewers grains
Add	Calcium chloride-di
Add	Calcium sulphate
Hay	Canola hay
Conc	Canola meal
Sil	Canola silage
Conc	Canola whole seed crushed
Conc	Carrots (fresh)
GFrq	Cereal - Dryland
GFrq	Cereal - Irrigated
GPas	Chicory
Bypr	Choc malt
Bypr	Chocolate waste
Bypr	Citrus pulp
GPas	Clover - Red - vegetative
Hay	Clover hay

- Make the Canola meal 10% of the mix by double-clicking on the 0.0 percentage cell to the left of its name, changing it to 8 and hitting return or enter.
Note the mix percent is now 98% with 2% remaining.
- Double-click on Triticale grain in the feed list to add it to the mix.
- Double-click on 0.0 next to Triticale grain in the mix and make it 5% of the mix.
Note the mix percentage is now 103% and it is showing you must remove -3% to finish the mix.
- Single-click on the row header of the Triticale grain row to select it and then click on the right arrow button (>) to remove it from the mix.
- Double-click on the 8 percent Canola meal and change it to 10% finishing off this mix.
- The mix now equals 100% so can be saved into the feed library by clicking on the 'Okay' button at the top right of the editor. If you wish to leave the demonstration mix as it was click on the 'Cancel' button to exit the mix editor without changing the mix.

Multiple feeds can be added to the mix by selecting the first feed, holding down the control key on the keyboard and then selecting the remaining feeds one at a time keeping the control key pressed. If you wish to add a block of feeds to the mix select the first feed, hold down the shift key on the keyboard and select the last feed of the block. Then release the control or shift key and click the add button (<) to add all the selected feeds to the mix in one go.

FACTORING IN LOSSES, FEED COSTS AND MILK PRICE

Introduction

Feeding rations comes with associated losses. The level of loss varies from feed to feed and on the storage and feeding environment. For example, losses can be surprisingly high for feeds such as hay, especially when fed out on the ground when conditions are wet. When using Rumen8 you enter what intake you think the cows are actually achieving (*ie* what the cows actually eat) and this assumes that any losses have occurred before this. However, losses affect the cost of the ration and should be considered when comparing the financial performance of a diet. This is easily done for feeds entered in the feed library. The cost of the diet has a major impact on profitability in a dairy enterprise along with the milk price received. Rumen8 factors in both the feed cost and milk price variables.

Remember, losses only apply to the feed cost. The feed amounts used to create a diet need to be the amounts actually eaten by the cow.

CASE STUDY 3.1 FACTORING IN LOSSES AND FEED COSTS

Exercise 16: Factoring in losses and costs - Method 1.

1. Go to the 'Edit feeds' page
 2. Highlight 'Barley Grain'
 3. Click 'Edit'
 4. Enter the values shown in Figure 27 below
- You can enter the cost as \$/t DM or \$/t fed and the other will be calculated and entered for you.

Figure 27. Example costs and losses for Barley grain.

Cost (\$/t DM)	250
Cost (\$/t fed)	220
Losses (%)	2
Cost +losses	\$255
Cost +loss. fr	\$224

5. Note that the cost after losses on a dry and as fed basis are shown below the entered values
6. Change the losses percentage to 10%
7. Note the change in the two cost after losses parameters at the bottom

Figure 28. Example costs and losses for Barley grain with losses increased to 10%.

Cost (\$/t DM)	250
Cost (\$/t fed)	220
Losses (%)	10
Cost +losses	\$278
Cost +loss. fr	\$244

8. If you want to keep this change then you would click 'Okay'

9. Change the 'Cost (\$/t)' to 280 - demonstrates how we can do that in this dialog box
10. Click 'Cancel' because we don't want to keep our changes

Exercise 17: Factoring in losses and costs - Method 2.

Under 'Cow' tab below 'Diet Components' enter the cow specs as below"

- Cow live weight 600 kg
- Live weight change 0 kg/day
- Number of cows in herd 1
- Milk yield 24 litres/day
- Milk fat 4.0 (%m/v)
- Milk protein 3.2 (%m/v)
- Days in milk 100
- Days pregnant 20
- Distance walked 2 km
- Farm terrain Flat

Create a ration using barley grain, lupin grain and a good quality ryegrass/clover silage rolls

On the main window click on the 'Feed cost' tab

1. Enter the costs and losses shown in Figure 29.

The 'Feed cost' tab is an alternative to the feed editor for adjusting costs and losses for those feeds in the current diet. Any changes will be saved to the feed library so if you are investigating the impact of higher or lower feed costs don't forget to put the actual cost back before exiting Rumen8.

Figure 29. After entering costs and losses for the example diet you can evaluate the diet with the measures in the bottom section of the window.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients

	DM	As Fed
1. Barley grain	2.20	2.50
2. Lupins grain	3.58	4.00
3. Ryegrass/clover silage - Good - R	12.00	32.88
4. None	0.00	0.00
5. None	0.00	0.00
6. None	0.00	0.00
7. None	0.00	0.00
8. None	0.00	0.00
9. None	0.00	0.00
10. None	0.00	0.00
11. None	0.00	0.00
12. None	0.00	0.00
13. None	0.00	0.00
14. None	0.00	0.00
15. None	0.00	0.00
Total	17.8	39.4

Animal **Diet** **Diet detail** **Milk price** **Feed cost** **Compare** **Notes**

Animal	Diet	Losses (%)	Cost after losses DM	Cost after losses as fed
211	185	2	\$215	\$189
357	320	2	\$364	\$327
120	44	15	\$141	\$52

Feed costs

\$/tonne	\$195
c/MJ ME	1.7
\$/kg CP	\$0.99
\$/cow/day	\$3.47

Milk income

\$/L raw milk	\$0.47
\$/kg ECM	\$0.47
\$/kg MS	\$6.58
\$/cow/day	\$11.38

Feed efficiency

Kg ECM/kg DM	1.3
Gm MS/kg DM	97
\$Milk/\$Feed	\$3.28

Margin

\$/cow/day	\$7.90
\$/herd/day	\$8
Feed % income	31
Milk yield adjustment (L/d)	24.0

- Note the diet performance measures in the bottom section of the window and in particular the \$/cow/day figure of \$7.90 in the Margin column on the right (Milk price is set to \$6/kg fat, \$8/kg protein and 2.2 cpl volume discount)
- Note the diet cost of \$195 \$/t
- Change the cost of barley to \$250 per tonne wet - note changes to the diet cost and margin

Figure 30. Note how the diet performance changes after the cost of the barley grain rises to \$250/t.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients			Animal	Diet	Diet detail	Milk price	Feed cost	Compare	Notes
		DM	As Fed	\$/t DM	\$/t as fed	Losses (%)	Cost after losses DM	Cost after losses as fed	
1.	Barley grain	2.20	2.50	285	250	2	\$291	\$255	
2.	Lupins grain	3.58	4.00	357	320	2	\$364	\$327	
3.	Ryegrass/clover silage - Good - R	12.00	32.88	120	44	15	\$141	\$52	
4.	None	0.00	0.00						
5.	None	0.00	0.00						
6.	None	0.00	0.00						
7.	None	0.00	0.00						
8.	None	0.00	0.00						
9.	None	0.00	0.00						
10.	None	0.00	0.00						
11.	None	0.00	0.00						
12.	None	0.00	0.00						
13.	None	0.00	0.00						
14.	None	0.00	0.00						
15.	None	0.00	0.00						
		17.8	39.4						

Feed costs		Milk income		Feed efficiency		Margin	
\$/tonne	\$205	\$/L raw milk	\$0.47	Kg ECM/kg DM	1.3	\$/cow/day	\$7.74
c/MJ ME	1.8	\$/kg ECM	\$0.47	Gm MS/kg DM	97	\$/herd/day	\$8
\$/kg CP	\$1.03	\$/kg MS	\$6.58	\$Milk/\$Feed	\$3.13	Feed % income	32
\$/cow/day	\$3.64	\$/cow/day	\$11.38			Milk yield adjustment (L/d)	24.0

- Change the losses for lupins grain to 10% - note changes in diet cost and margin

Figure 31. Note how the diet performance changes after the lupin grain losses increase to 10%.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients			DM	As Fed	Animal	Diet	Diet detail	Milk price	Feed cost	Compare	Notes
					\$/t DM	\$/t as fed	Losses (%)		Cost after losses DM		Cost after losses as fed
1.	Barley grain		2.20	2.50	285	250	2		\$291		\$255
2.	Lupins grain		3.58	4.00	357	320	10		\$397		\$356
3.	Ryegrass/clover silage - Good - R		12.00	32.88	120	44	15		\$141		\$52
4.	None		0.00	0.00							
5.	None		0.00	0.00							
6.	None		0.00	0.00							
7.	None		0.00	0.00							
8.	None		0.00	0.00							
9.	None		0.00	0.00							
10.	None		0.00	0.00							
11.	None		0.00	0.00							
12.	None		0.00	0.00							
13.	None		0.00	0.00							
14.	None		0.00	0.00							
15.	None		0.00	0.00							
			17.8	39.4							

Feed costs		Milk income		Feed efficiency		Margin	
\$/tonne	\$211	\$/L raw milk	\$0.47	Kg ECM/kg DM	1.3	\$/cow/day	\$7.62
c/MJ ME	1.8	\$/kg ECM	\$0.47	Gm MS/kg DM	97	\$/herd/day	\$8
\$/kg CP	\$1.07	\$/kg MS	\$6.58	\$Milk/\$Feed	\$3.03	Feed % income	33
\$/cow/day	\$3.75	\$/cow/day	\$11.38			Milk yield adjustment (L/d)	24.0

- If we exit Rumen8 now then the changes we have made will be saved to the feeds as they exist in the feed library.
- Put the costs and losses back to values that are reasonable for your farm and feed suppliers.

OPTIMISING FEED PROFITABILITY

Feeding for yield and feeding **profitably** for yield are very different! Working with feed costs and feed losses has highlighted the effect of these parameters on the bottom line margin in dollars per cow.

The other factor influencing margins is the milk price received. The milk price varies throughout the season and this has a huge impact on margins. Seasonally feed costs vary depending on the proportions of purchased feed versus conserved forages versus grazed pastures. Optimising returns to feed for each month is important.

Rumen8 allows milk prices to be entered for each month. When a particular month is selected Rumen8 will calculate the margin per cow factoring in the feed price and milk price for that month.

CASE STUDY 3.2 ENTERING MILK PRICE

Exercise 18: Entering milk prices.

1. Click 'Milk price' tab on the main window

Figure 32. The Milk price entry tab has room for 12 milk prices by volume or by components.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients

	DM	As Fed
1. Barley grain	3.51	4.00
2. Lupins grain	5.38	6.00
3. Ryegrass/clover silage - Good - R	10.40	28.49
4. None	0.00	0.00
5. None	0.00	0.00
6. None	0.00	0.00
7. None	0.00	0.00
8. None	0.00	0.00
9. None	0.00	0.00
10. None	0.00	0.00
11. None	0.00	0.00
12. None	0.00	0.00
13. None	0.00	0.00
14. None	0.00	0.00
15. None	0.00	0.00
	19.3	38.5

Animal Diet Diet detail Milk price Feed cost Compare Notes

Milk Payment

	Price (cpl)	Equivalent by MS (\$/kg)
1. 45	45	6.25
2. 0	0	0.00
3. 0	0	0.00
4. 0	0	0.00
5. 0	0	0.00
6. 0	0	0.00
7. 0	0	0.00
8. 0	0	0.00
9. 0	0	0.00
10. 0	0	0.00
11. 0	0	0.00
12. 0	0	0.00

Payment

☐ Components

☒ Volume

Feed costs

\$/tonne	\$0
c/MJ ME	0.0
\$/kg CP	\$0.00
\$/cow/day	\$0.00

Milk income

\$/L raw milk	\$0.45
\$/kg ECM	\$0.45
\$/kg MS	\$6.25
\$/cow/day	\$10.80

Feed efficiency

Kg ECM/kg DM	1.2
Gm MS/kg DM	-
\$Milk/\$Feed	\$6.72

Margin

\$/cow/day	\$10.80
\$/herd/day	\$11
Feed % income	0
Milk yield adjustment (L/d)	24.0

2. There are 12 entry boxes. These are generally used to enter the milk price for each of the 12 months of the year. However, you may want to compare two or more prices on offer or as part of a budgeting exercise
3. Note the payment options shown in Figure 33

Figure 33. The Milk price payment option.

Payment

☐ Components

☒ Volume

You can choose to use payment based on fat, protein and volume discount or just on a volume basis

1. Click the 'Components' button - note the format
2. Click on the 'Volume' button
3. Using the table below populate the 12 price boxes

Table 3. An example of a monthly milk price schedule

Month	Price c/L
Jul	44.5
Aug	43.1
Sep	40.7
Oct	40.7
Nov	42.9
Dec	50.5
Jan	55.5
Feb	54.1
Mar	45.7
Apr	45.0
May	45.0
Jun	42.2

Exercise 19: Diet formulation and margin per cow analysis

You are designing a ration for summer feeding for the month of January with the following cow details:

- Cow live weight 600 kg
- Live weight change 0.2 kg/day
- Number of cows in herd 1
- Milk yield 24 litres
- Milk fat 3.6 (%m/v)
- Milk protein 3.2 (%m/v)
- Days in milk 200
- Days pregnant 100
- Distance walked 2 km
- Farm terrain Flat

Use feeds and prices relevant to your business

What is your daily margin per cow for the month?

What decisions can you make to make the margin more favourable?

CASE STUDY 3.3 COMPARING DIETS

Rumen8 allows for up to three diets to be compared to facilitate decision making. The main basis for decision making relates to the margin per cow per day. The diet offering the highest margin would be the one to select. However, you might want to compare margins to the same diet using different milk prices on offer over different months of the year.

Exercise 20: Using the compare function

1. Use the diet from the previous exercise. Add any other feeds that you want to use in the comparison but have zero in the amounts box. Milk price is 44.5 cpl.
2. Click the 'Compare' tab
3. Click 'S' under Diet 1 to store the diet in slot 1

Figure 34. The current diet has been stored in slot 1 of the Compare tab.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients

	DM	As Fed
1. Wheat grain	3.51	4.00
2. Lupins grain	2.51	2.80
3. Canola meal	0.90	1.00
4. Ryegrass/clover silage - Good - R	9.00	24.66
5. Ryegrass/clover hay - Average	3.00	3.48
6. None	0.00	0.00
7. None	0.00	0.00
8. None	0.00	0.00
9. None	0.00	0.00
10. None	0.00	0.00
11. None	0.00	0.00
12. None	0.00	0.00
13. None	0.00	0.00
14. None	0.00	0.00
15. None	0.00	0.00
	18.9	35.9

Feed costs

\$/tonne	\$369
c/MJ ME	3.3
\$/kg CP	\$1.98
\$/cow/day	\$6.99

Milk income

\$/L raw milk	\$0.45
\$/kg ECM	\$0.47
\$/kg MS	\$6.54
\$/cow/day	\$10.68

Feed efficiency

Kg ECM/kg DM	1.2
Gm MS/kg DM	86
\$Milk/\$Feed	\$1.53

Margin

\$/cow/day	\$3.69
\$/herd/day	\$4
Feed % income	65
Milk yield adjustment (L/d)	24.0

Compare

Animal	Diet	Diet detail	Milk price	Feed cost	Compare	Notes					
1.	S	R	C	2.	S	R	C	3.	S	R	C
Name											
1	3.51kg Wheat grain	-	-	-	-	-					
2	2.51kg Lupins grain	-	-	-	-	-					
3	0.90kg Canola meal	-	-	-	-	-					
4	9.00kg Ryegrass/clover silage -	-	-	-	-	-					
5	3.00kg Ryegrass/clover hay - A	-	-	-	-	-					
6	-	-	-	-	-	-					
7	-	-	-	-	-	-					
8	-	-	-	-	-	-					
9	-	-	-	-	-	-					
10	-	-	-	-	-	-					
11	-	-	-	-	-	-					
12	-	-	-	-	-	-					
13	-	-	-	-	-	-					
14	-	-	-	-	-	-					
15	-	-	-	-	-	-					
DMI	18.9kg (103/94 % DMI)	-	-	-	-	-					
ME	215 / 204 MJ	-	-	-	-	-					
MP	2036 / 1918 g (19%)	-	-	-	-	-					
Margin	\$3.69/cow/day	-	-	-	-	-					

4. Compare the diet based on milk price
5. Click 'Prices'
6. In the box for the period selected increase the price by 10 c/L
7. Click 'Compare'
8. Click 'Store' under Diet 2
9. Note the different margin per cow

Figure 35. The current diet has been stored in slot 2 of the Compare tab after increasing the milk price by 10 cpl.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients			DM	As Fed
1.	Wheat grain		3.51	4.00
2.	Lupins grain		2.51	2.80
3.	Canola meal		0.90	1.00
4.	Ryegrass/clover silage - Good - R		9.00	24.66
5.	Ryegrass/clover hay - Average		3.00	3.48
6.	None		0.00	0.00
7.	None		0.00	0.00
8.	None		0.00	0.00
9.	None		0.00	0.00
10.	None		0.00	0.00
11.	None		0.00	0.00
12.	None		0.00	0.00
13.	None		0.00	0.00
14.	None		0.00	0.00
15.	None		0.00	0.00
			18.9	35.9

Feed costs		Milk income		Feed efficiency		Margin	
\$/tonne	\$369	\$/L raw milk	\$0.55	Kg ECM/kg DM	1.2	\$/cow/day	\$6.09
c/MJ ME	3.3	\$/kg ECM	\$0.57	Gm MS/kg DM	86	\$/herd/day	\$6
\$/kg CP	\$1.98	\$/kg MS	\$8.01	\$Milk/\$Feed	\$1.87	Feed % income	53
\$/cow/day	\$6.99	\$/cow/day	\$13.08			Milk yield adjustment (L/d)	24.0

Animal	Diet	Diet detail	Milk price	Feed cost	Compare	Notes	
1.	S	R	C	2.	S	R	C
Name							
1	3.51kg Wheat grain	3.51kg Wheat grain	-				
2	2.51kg Lupins grain	2.51kg Lupins grain	-				
3	0.90kg Canola meal	0.90kg Canola meal	-				
4	9.00kg Ryegrass/clover silage -	9.00kg Ryegrass/clover silage -	-				
5	3.00kg Ryegrass/clover hay - A	3.00kg Ryegrass/clover hay - A	-				
6	-	-	-				
7	-	-	-				
8	-	-	-				
9	-	-	-				
10	-	-	-				
11	-	-	-				
12	-	-	-				
13	-	-	-				
14	-	-	-				
15	-	-	-				
DMI	18.9kg (103/94 % DMI)	18.9kg (103/94 % DMI)	-				
ME	215 / 204 MJ	215 / 204 MJ	-				
MP	2036 / 1918 g (19%)	2036 / 1918 g (19%)	-				
Margin	\$3.69/cow/day	\$6.09/cow/day	-				

10. Click 'Diet'
11. Use a different feed concentrate component to formulate another diet
12. Click 'Compare'
13. Click 'Store' under Diet 3

Figure 36. The current diet has been stored in slot 3 of the Compare tab after changing an ingredient and the amount fed.

New Diet* - Rumen8 registered to Richard Morris

File Edit Animal View Help

Diet ingredients			DM	As Fed
1.	Barley grain		2.91	3.31
2.	Lupins grain		2.51	2.80
3.	Canola meal		0.90	1.00
4.	Ryegrass/clover silage - Good - R		9.00	24.66
5.	Ryegrass/clover hay - Average		3.00	3.48
6.	None		0.00	0.00
7.	None		0.00	0.00
8.	None		0.00	0.00
9.	None		0.00	0.00
10.	None		0.00	0.00
11.	None		0.00	0.00
12.	None		0.00	0.00
13.	None		0.00	0.00
14.	None		0.00	0.00
15.	None		0.00	0.00
			18.3	35.3

Feed costs		Milk income		Feed efficiency		Margin	
\$/tonne	\$326	\$/L raw milk	\$0.55	Kg ECM/kg DM	1.2	\$/cow/day	\$7.10
c/MJ ME	2.9	\$/kg ECM	\$0.57	Gm MS/kg DM	89	\$/herd/day	\$7
\$/kg CP	\$1.75	\$/kg MS	\$8.01	\$Milk/\$Feed	\$2.19	Feed % income	46
\$/cow/day	\$5.98	\$/cow/day	\$13.08			Milk yield adjustment (L/d)	24.0

Animal	Diet	Diet detail	Milk price	Feed cost	Compare	Notes	
1.	S	R	C	2.	S	R	C
Name							
1	3.51kg Wheat grain	3.51kg Wheat grain	2.91kg Barley grain				
2	2.51kg Lupins grain	2.51kg Lupins grain	2.51kg Lupins grain				
3	0.90kg Canola meal	0.90kg Canola meal	0.90kg Canola meal				
4	9.00kg Ryegrass/clover silage -	9.00kg Ryegrass/clover silage -	9.00kg Ryegrass/clover silage -				
5	3.00kg Ryegrass/clover hay - A	3.00kg Ryegrass/clover hay - A	3.00kg Ryegrass/clover hay - A				
6	-	-	-				
7	-	-	-				
8	-	-	-				
9	-	-	-				
10	-	-	-				
11	-	-	-				
12	-	-	-				
13	-	-	-				
14	-	-	-				
15	-	-	-				
DMI	18.9kg (103/94 % DMI)	18.9kg (103/94 % DMI)	18.3kg (105/91 % DMI)				
ME	215 / 204 MJ	215 / 204 MJ	205 / 204 MJ				
MP	2036 / 1918 g (19%)	2036 / 1918 g (19%)	1917 / 1918 g (19%)				
Margin	\$3.69/cow/day	\$6.09/cow/day	\$7.10/cow/day				

14. Note the effect on margin per cow per day
15. To work with any of the three stored diets, click on 'R' and that diet will be recalled and overwrite the current diet in the ingredients list
16. To remove any of the three stored diets. Click on 'C' and the diet will be cleared from the compare display

CONCLUSION

This manual has covered the key functions of Rumen8. Practice in using the program and its 'calibration' with what is observed on ground will give increasing confidence to the user that the diet being fed will be effective in meeting the nutritional requirement for cows with given milk yields and milk composition. The program will also aid in decision making when it comes to purchasing feeds, especially where the quality of the feed being fed has been tested. The program also informs decision making around milk and feed prices.

Rumen8 is not designed for advice on the addition of rumen buffers and rumen modifiers. It is important to consult a nutritionist for advice when it comes to the use of buffers and rumen modifiers.