Assessing fodder quality for improved Farm management

Mornington Peninsula 2017

Australian Government

National Landcare Program

Demonstratin Sustainabl FARM PRACTICE

MORNINGTON PENINSULA

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ASSESSING FODDER QUALITY FOR IMPROVED FARM MANAGEMENT

The Story: Assessing Fodder Quality for Improved Farm Management

Name: Mornington Peninsula Farmer Discussion Group Participants

Farm: Multiple farms situated on the Mornington Peninsula

Overview

The aim of the project was to increase the understanding and uptake of innovative and sustainable farming practices to:

- Enhance the quality of fodder conserved on the Mornington Peninsula
- Improve the nutritional outcomes for livestock.

Livestock farming in this region is predominantly undertaken on smaller holdings. The major enterprise is beef production, where weaner steers are purchased and finished over 12-18 months to become 550-650kg bullocks.

There were 17 participants in the project from farms on the Mornington Peninsula. Hay or silage samples were taken from each of the farms in 2015 and 2017 and sent away to FEEDTEST laboratories for analysis. The farmers were then invited to a workshop to discuss the results and understand the quality of the fodder they were producing. The results showed that a variety of factors impacted the quality of the fodder, most noticeably the time of year the hay was cut, and the grass species found in the pasture.

The challenges to producing quality fodder on the Mornington Peninsula

Economies of scale mean that most producers rely heavily on contractors for their fodder conservation of hay and silage. Although the area is well serviced by a number of well-organised and equipped operators, the reality is that contractors are not able to meet the optimum mowing, raking and baling times for every landholder. Forage quality is impacted greatly by the stage of maturity. As forage crops mature, fibre increases while digestibility and crude protein decreases. The result is that much of the hay produced on the Mornington Peninsula is cut weeks late resulting in fodder which is poor quality (low in digestibility, metabolisable energy and protein).

A further challenge to conserving quality fodder is the spring weather, which typically brings regular rainfall during the hay season. This leaves only narrow windows of opportunity for contractors to cut rake and bale.

Pasture quality can also reduce fodder quality outcomes, with many hay paddocks dominated by poorer grass species such as sweet vernal, fog grass, barley grass and brome. These species tend to mature early in the spring resulting in a low percentage of leaf in the hay and much of the bulk taken up by stem, which is of poor digestibility.

Whilst rolled and wrapped silage is made early in the season, the bulk of fodder conserved in the area is pasture hay.

Fodder sampling

In order to improve grower awareness and an understanding of fodder quality, samples of hay and silage were taken for analysis in 2015 and 2017. The poor seasonal conditions in spring of 2015 meant that very little hay or silage was made in that year and hence no sampling took place in 2016.

The first batch of sampling was completed in 2015 and included 16 hay samples and 5 samples of silage from a total of 12 farms. The second batch was completed in 2017 and included 14 hay samples and 15 samples of silage from a total of 13 farms. All samples were documented and sent via Express Post to the FEEDTEST laboratory, at Agrifood Technology in Werribee.

Sampling was done using a cordless drill with a 500mm x 20mm sampling corer. 10 sample cores were collected from 10 individual bales (1 sample core per bale totaling 10 sample cores) which were representative of the fodder conserved. The 10 sample cores were then compiled into 1 sample and sent off for analysis.

Figure 1: *David Stewart and Jim Bailey collecting hay samples.*

Understanding silage and hay test analysis results

A feed analysis is essential for understanding the nutritive value of the fodder and how successful the harvesting and ensiling process has been. It also highlights what may need to be done next season to improve the quality of the fodder. A basic nutrient analysis will measure forage moisture, fibre, energy and protein. These figures contribute in balancing the diet and estimating intake levels relative to performance. Additional tests can be ordered for minerals if required.

The major components analysed include;

- **MOISTURE** is the amount of water in the feed, varying from about 10% for grains and to over 80% for fresh pasture.

- **DRY MATTER (DM)** refers to the amount of feed remaining after the water has been removed. Because the water content of feeds can vary considerably, all analyses are expressed on a dry matter basis.

- **CRUDE PROTEIN (CP)** is the amount of true protein (composed of amino acids) and non-protein nitrogen in the feed. Whilst it is desirable to have a high CP it can be misleading to use as the sole measure of feed quality. A feed having a CP of about 16-18% is sufficient to meet high levels of milk production. Remember it is the CP content of the whole diet that is important so a low CP hay can be offset by a high CP silage or hay.

- **METABOLISABLE ENERGY (ME)** is the feed energy actually used by the animal, calculated from Digestible Dry Matter (DDM) and expressed as megajoules per kilogram of dry matter (MJ/kg DM). ME is the most important figure on the report. It is used to calculate whether stock are receiving adequate energy for maintenance or production. High fibre feeds are less digestible and so are lower in ME. Low fibre diets are more digestible so higher in ME. In a balanced diet, feed intake and animal production increases with increasing ME. Fodder must have ME values greater than 10 for high rates of animal production.

- **Fibre** is often measured using two methods.
    - **ACID DETERGENT FIBRE (ADF)** estimates the cellulose and lignin content of a feed. The lower the ADF, the higher the DDM (and ME).

    - **NEUTRAL DETERGENT FIBRE (NDF)** estimates the total cell wall content in a feed, and is the most useful measure of fibre content currently available.

- **DIGESTIBLE DRYMATTER (DDM)** is the percentage of the feed dry matter actually digested by animals, estimated using a laboratory method which is standardised against DDM values from feeding trials. High quality feeds have a DDM of over 65%, whilst feeds below 55% DDM are of poor quality and will not maintain liveweight even if stock have free access to it.

- **FODDER GRADES -** The need for a common fodder description "language" or grading system has been achieved and is based on objective measurements. These grades relate fodder quality (hay and silage) to livestock performance. These allow both buyer and seller to instantly recognise quality by means of a simple alpha-numeric code. The grade can appear on fodder analysis reports and on the Vendor Declaration Forms. A grade of A1 is the highest quality fodder and a grade D4 is the lowest quality fodder (see table 1).

Table 1: AFIA Grades for Legume and Pasture Hay & Silage

DDM%	ME	Crude Protein %			
	MJ/kg	>19	14-19	8-13	<8
>66	>9.5	A1	A2	A3	A4
60-66	8.7-9.5	B1	B2	B3	B4
53-59	7.4-8.6	C1	C2	C3	C4
		D1	D2	D3	D4

ME (MJ/kg DM) Metabolisable energy megajoules per kilogram of DM
DDM (%) Digestible dry matter
CP (% of DM) Crude protein, % of DM
DM Dry Matter

First workshop (August 2015) - analysis of FEEDTEST results 2015

In August 2015, the Mornington Peninsula group convened for a workshop to review the test results and discuss the implications for future decisions on fodder conservation.

At the workshop, a number of grab samples representing the core material tested were displayed, and the group were asked to do a visual assessment before the actual test results were revealed to them. The exercise demonstrated that most participants could correctly identify the very best and the very worst samples, but much of the other fodder on display was difficult to assess in terms of protein, metabolisable energy and digestibility.

Figure 2: *Looking at the grab samples to make a visual assessment*

The report titled “Understanding your Feedtest Report” (appendix 1) was provided to each participant and used to explain the test results for every sample.

Members were also provided with the table “Grades for Legume and Pasture hay & Silage”, (see table 1) which is published by the Australian Fodder Industry Association (AFIA). The table shows the rating for each sample, from A1 through to D4, which appears on each farmers’ sample test report.

The test results (2015)

Table 2 shows the test results for 2015. The results are listed by grade quality, from A1 to D4. The silage results are shown in green, and the hay results are shown in yellow.

TABLE 2: Test results for silage and hay 2015

Property	Type of fodder	Grade	% dry matter	Crude protein %	Digestibility (DDM) %	Metabolisable energy MJ/kg DM
Matt	Silage (luc)	A1	68.1	23.3	66.8	10.1
Matt	Hay (north)	A2	83.3	14.4	68.2	10.1
Parnham	Oat silage	A2	54.9	8.2	66.3	10.1
C Watkins	Silage	A3	51.3	11.0	66.4	10.1
Gardner	Silage	A3	60.8	10.3	67.4	10.2
C Watkins	Hay	A3	85.3	9.7	65.6	9.7
Fallick	Silage	B3	55.3	9.2	61.2	9.4
Young	Hay	B3	83.4	12.3	60.0	8.7
Young	Hay	B3	86.6	10.3	62.6	9.2
John	Hay (Hast)	B3	80.6	12.0	60.4	8.8
Elgee Park	Hay	B3	85.5	9.2	62.3	9.1
Matt	Oaten hay	B3	84.5	10.3	62.4	9.1
Gardner	Hay	B4	86.2	6.7	66.7	8.8
Fallick	Hay	C4	87.6	5.9	56.4	8.1
Morrisey	Hay (Balna)	C4	87.7	5.6	56.7	8.1
Morrisey	Hay (Som)	C4	82.3	4.6	53.7	7.6
Coghill	Hay	C4	85.7	7.4	55.8	8.0
Stacey	Hay	C4	87.9	6.2	56	8.0
Stacey	Hay	C4	85.8	7.9	55.2	7.9
Elgee Park	Hay	C4	86.9	7.3	57.0	8.2
Geoff & Linda	Hay	D4	83.8	3.6	41.5	5.5

The results for the 2015 sampling (see Table 2 above) were discussed by the group. The results confirmed that 8 of the 16 hay samples from the previous season were of grade C or D. Six of the remaining eight hay samples were either A or B grade and made by contractors on their own properties or by an owner with their own equipment. Contractors (or farmers) with their own equipment have more control over the timing of when they harvest their own fodder.

Of particular interest were two samples from Young's property which made B3 grade. This property is on the light coastal sand country on the southern Peninsula, where Kikuyu grass is at the start of its active growing phase during the late spring and early summer.

Although Kikuyu is often seen as an undesirable species in pastures, in this case it was cut at a time when the plant had a good proportion of leaf and subsequently rated well for protein and digestibility. Given the difficulty of establishing any quality pastures on this light country, the result provided cause for more discussion about the value of using this plant as a managed pasture species.

Of the five samples of silage (highlighted in green), only two were contractors cutting on their own properties and three from properties relying on contractors. The sample which tested as B3 was cut relatively late for silage.

The overall conclusion from this workshop was that some participants would give more consideration to cutting silage in future despite the additional wrapping cost. It was agreed that once the cost per MJ of feed was calculated and taken into consideration, the additional cost of making silage more than offset the wrapping costs.

Second workshop (2017) - Analysis of FEEDTEST results

In 2017 there was a greater level of participation in the project with 29 samples taken for testing. Interestingly, there was a noticeable increase in the amount of silage made compared to the 2015 season. Once again, the group convened at a local property to review the results as detailed below in Table 3.

Figure 3: *Presenting to participants at a workshop.*

The test results (2017)

Table 3 shows the test results for 2017. The results are listed by grade quality, from A1 to D4. The silage results are shown in green, and the hay results are shown in yellow.

TABLE 3: Test results for silage and hay 2017

Property	Type of fodder	Grade	% dry matter	Crude protein %	Digestibility (DDM) %	Metabolisable energy MJ/kg DM
Stacey	Silage	A3	39.4	12.7	66.7	10.1
Fallick	Silage	A3	46.0	11.7	67.0	10.2
Fallick	Silage	A3	48.0	11.4	68.1	10.3
Geoff & Linda	Silage	A3	39.5	10.6	64.9	9.9
Coghill	Silage (SN)	A3	43.0	8.8	66.2	10.1
Coghill	Silage (SS)	A3	43.3	10.0	64.0	9.8
Watkins	Silage	A3	37.2	11.8	71.4	10.8
Pederson	Silage (oat)	A3	38.8	7.1	66.5	10.1
Young	Silage	A3	50.5	12	65.0	10
Clayton	Silage	A3	65.0	10.3	63.0	9.6
Gibb	Silage	A3	50	11.7	69.2	10.5
Young	Silage	A4	47.7	9.0	62.9	9.6
Young	Silage	A4	52.6	6.9	63.7	9.7
Franklin	Silage	B3	48.8	10.9	61.0	9.4
Franklin	Silage	B3	31.5	9.7	60.1	9.2
Stacey	Hay (small)	B4	84.7	7.2	60.9	8.9
Watkins	Hay (small)	B4	87.9	7.7	64.0	9.4
Watkins	Hay	B4	89.0	7.4	64.4	9.5
Wyatt	Hay	C3	85.6	8.7	55.6	7.9
Gibb	Hay	C3	85.8	9.3	58.2	8.4
Stacey	Hay	C4	86.8	5.5	55.7	8.0
Gardner	Hay	C4	89.7	5.8	54.2	7.7
Coghill	Hay (HWE)	C4	89.8	7.3	58.3	8.4
Coghill	Hay (HSE)	C4	89.4	4.8	58.6	8.5
Wyatt	Hay (Ben)	C4	86.6	6.3	54.1	7.7
Pedersen	Hay	C4	86.9	6.5	52.2	7.4
Young	Hay	C4	88.6	56	53.0	7.5
Morissey	Hay (Som)	D4	89.6	3.2	48.3	6.7
Coghill	Hay (HSW)	D4	89.9	3.9	51.3	7.2

The results show a significant shift to silage from 2015 to 2017, with 15 of the 29 samples being pasture silage. All but two of these samples (13 of the 15) were graded as either A3 or A4, which is considerably higher quality, confirming that the additional expense and early cut of pastures was justified.

In contrast, all but three of the hay samples tested graded as C or below, with the three samples which graded B4 belonging to farmers with their own equipment.

One standout was from Geoff and Linda's property. In 2015 they had hay graded as D4, and in 2017 they switched to silage and had an A3 result, using the same paddock.

Summary of results

Silage

1. Of the 20 samples of silage taken over the 2 seasons the lowest grading was a B3 and 17 made A grade.
2. The lowest Metabolisable Energy (ME) for any silage was 9.2.
3. The digestibility of all the silage was above 60% with most samples well above 64%
4. The two silage samples with a relatively low Crude Protein (CP) of about 7% made A grade because of high digestibility and ME.
5. Even relatively poor quality, grass-based sweet vernal pastures made reasonably high quality silage.
6. To make the best quality, high protein silage requires a significant proportion of legume in the pasture.
7. Paddocks which were not grazed at all during the year still made good silage, whereas the same paddocks left for hay later in the same season only made poor C grade hay.

Hay

1. The only three samples of hay which made A grade were in season 2014/15 and were baled by two different contractor-owners.
2. There was no A grade hay sampled in 2016/17.
3. There were three B samples, nine C samples and two D samples of hay in 2016/17.
4. One of the D4 samples was made from almost pure ryegrass pasture which was cut very late and only had a 3.2% CP (effectively just straw).
5. The three samples of hay in 2016/17 which made B grade did so because of relatively high digestibility and ME, rather than CP.

Conclusion

The results show that if you have your own equipment, or can access a contractor before the pasture matures, and have good quality grass and legume based pastures, then it is possible to make high quality hay on the Peninsula. This also depends on favourable weather conditions to provide a window of opportunity for drying the fodder between cutting and baling.

A restricting factor for some landholders considering making or incorporating silage into their farm management, continues to be the need to own a tractor with a safe lifting capacity and a silage grab necessary for handling and feeding out. Farmers that don't own their own equipment, but have access to a contractor who can harvest at the appropriate time, can make A grade quality silage. Silage will likely be cut early, on time and before the main part of the hay season commences, requiring only 2 days to cut, rake, roll and wrap. Results have shown that even with poor quality pasture species present, it is possible to achieve A grade silage through cutting early before the pasture has matured.

Key points to making successful hay and silage

- Start with high quality forage.
- Cut at the recommended growth stage - Forage quality declines as the crop or pasture matures.
- Timing of harvest is important - consider the weather and also the effect on pasture regrowth.
- Harvest at the target dry matter level - certain additives will improve silage fermentation if wilting conditions are poor, but won't compensate for poor silage management (late harvest, slow wilting or poor sealing).
- Aim for high density bales to minimise air pockets - wrap bales as soon as possible after baling.
- Minimise damage to stretchwrap by wrapping at the storage site or use specialist equipment to transport bales to storage.
- Consider investing in suitable harvesting, storage and feedout systems to increase efficiency and profitability
- Develop a close working relationship with your contractor and liaise to identify the optimum time and window to conserve fodder.

Outcomes

Group members now have a greater understanding of the importance of conserving quality hay and silage and the difficult seasonal and pasture quality challenges posed.

The realisation of the generally poor nutritional quality of hay in the area has resulted in farmers making a significant shift over the last 2 seasons towards silage and away from hay, so as to enhance digestibility, ME and protein levels.

Those considering purchasing hay are now aware of the value of insisting on a FEEDTEST sample analysis prior to purchase and the potential for improving the nutritional intake of livestock throughout the year.

In 2018 group members will be given the option to be involved in another coordinated round of sampling and analysis, at their own expense, to evaluate the standard of fodder conserved during the 2017 season.

References

1. https://futurebeef.com.au/knowledge-centre/hay-and-silage-analyses-what-do-they-mean/
2. https://www.mla.com.au/news-and-events/industry-news/what-do-silage-and-hay-test-figures-mean/
3. https://www.afia.org.au/index.php/17-quality/24-national-grades
4. https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/229286/10-key-steps-to-successful-silage.pdf

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APPENDIX 1 UNDERSTANDING YOUR FEEDTEST REPORT

Your FEEDTEST report will contain some or all of the following terms:

MOISTURE is the amount of water in the feed, varying from about 10% for grains and to over 80% for fresh pasture.

DRY MATTER (DM) refers to the amount of feed remaining after the water has been removed. Because the water content of feeds can vary considerably, all analyses are expressed on a dry matter basis.

CRUDE PROTEIN (CP) is the amount of true protein (composed of amino acids) and non-protein nitrogen in the feed. Whilst it is desirable to have a high CP, it can be misleading to use as the sole measure of feed quality.

DIGESTIBLE DRYMATTER (DDM) is the percentage of the feed dry matter actually digested by animals, estimated using a laboratory method which is standardised against DDM values from feeding trials. High quality feeds have a DDM of over 65%, whilst feeds below 55% DDM are of poor quality and will not maintain liveweight even if stock have free access to it.

METABOLISABLE ENERGY (ME) is the feed energy actually used by the animal, calculated from DDM and expressed as megajoules per kilogram of dry matter (MJ/kg DM). ME is the most important figure on the report. It is used to calculate whether stock are receiving adequate energy for maintenance or production.

ACID DETERGENT FIBRE (ADF) estimates the cellulose and lignin content of a feed. The lower the ADF,the higher the DDM (and ME).

NEUTRAL DETERGENT FIBRE (NDF) estimates the total cell wall content in a feed, and is the most useful measure of fibre content currently available.

WATER SOLUBLE CARBOHYDRATES(WSC) is a measure of the total soluble sugars which are present in forage. These sugars include glucose, fructose, sucrose and fructans and are almost completely digestible.

CONVERTING FEEDTEST RESULTS FROM A "DRY MATTER" TO AN "AS FED" BASIS All FEEDTEST analyses are expressed on a dry matter basis. However, in the paddock, you will need to calculate the amount of feed supplement to use on an "as fed" basis.

For example, if a sample of oats has an ME of 11MJ/kg DM, a CP of 9% (on a DM basis) and a DM content of 90%, the "as fed" values will be :

ME = 11 x 90% = 10 MJ/kg feed
CP = 9 x 90% = 8% CP in feed

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THE PROTEIN & ENERGY CONTENT OF SOME COMMONLY USED FEEDS

The table below indicates the range and average values of protein and energy for some commonly used feeds, based on experience with FEEDTEST samples. This will allow you to see where your sample fits in. It is intended as a guide only and may not apply to all samples of a given type.

As samples are received from many different environments, soil types, seasons, etc., variability will always be high. Use of average values for calculating feed requirements can be unreliable.

Feed Type	Crude Protein (% of dry matter)		Metabolisable Energy (MJ/kg dry matter)	
	Range	Average	Range	Average
Hay/Silage				
Mixed pasture	5 – 19	11	6 - 10	8
Lucerne	16 – 25	20	8 – 10	9
Clover	14 – 21	18	8 – 11	10
Medic	12 – 22	17	8 – 10	9
Cereal	5 - 10	7	7–9	8
Pelleted Mixed feeds	8 – 23	12	5 – 12	8
Cereal grains				
Oats	5 – 15	9	9 – 12	11
Barley	7 – 15	10	12 – 13	12
Wheat	8 – 16	11	12 – 13	13
Triticale	7 – 16	11	12 - 13	13
Grain Legumes				
Lupins	28 – 36	32	12 – 13	13
Peas	20 - 27	24	12 – 13	13
Faba beans	25 – 27	26	12 – 13	13

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