Filling Feed Gaps – Hay vs silage production for the Eyre Peninsula

Preparing for drought through best practice feed conservation and storage is critical for Eyre Peninsula livestock producers. This fact sheet has been developed as a tool to improve farmer decision making around cost effective and sustainable production of hay and silage.

KEY MESSAGES

- If cut and baled correctly, legumes usually make better hay than silage; quality hay generally has a better price point than quality silage.
- More fermentation with lactic acid = quality silage.
- Two livestock feed quality testing systems are used in Australia, both of which use NIR (Near Infra-Red spectroscopy). It is not recommended to compare results using different laboratory results, as the systems used vary.
- Samples for fodder analysis must be collected using a corer, not a grab sample from the bale or from the feed out trail.

HAY VS SILAGE

Silage is a fermented product, much like beer but with less (or no) alcohol. The fermentation process is anaerobic so it must proceed with no air (oxygen). If air is present, compost is produced, not silage. During anaerobic fermentation, lactic acid is produced which preserves the crop or pasture.

Keys to successful silage production:

Good silage must be baled (or chopped) within 1-2 days of cutting and wrapped (or sealed) immediately following baling or carted to a pit/bunker.

Air is excluded by baling (or chopping and rolling) whilst the forage is still wet, but not too wet. Aim for 60-70% water for chopped silage and 40-50% water for baled silage. Silage must be wrapped quickly and tightly, or sealed in a pit/bunker to prevent air entering. Air is the enemy of silage!

The more sugar in the cereal or pasture, the better the fermentation and therefore better silage quality. Cereals and annual/Italian ryegrasses make the best silage. Lucerne, legumes (medics and clovers) and brassicas such as capeweed/mustards/turnips are difficult to turn into silage as they have very low sugar content.

Good silage will have a low pH (4.0 to 5.0) compared to the freshly cut crop/pasture with a pH around 6.5 to 7 and mostly lactic acid with only a small amount (or nil) acetic and no butyric acid.

Lactic acid does not smell. If your silage smells, this means you have an “off” fermentation such as butyric acid. This will be a result of baling (or chopping) too wet, insufficient sugar for fermentation, air getting into the stack/bale or crop/pasture being left for too long between cutting and chopping/baling.

Although difficult to turn into silage, legume dominant pastures make very good hay if wilted quickly.

Two balansa clover/ryegrass hay samples from lower Eyre Peninsula tested 11.0 ME, 35% NDF and 22% CP (2023 cut) and 10.7 ME, 41% NDF and 20% CP (2022 cut). This shows that good quality hay can be made in both a good hay season (2023) and poor (wet spring) season (2022). Legumes usually make better hay than silage and good hay will be cheaper than good silage.

COLLECTING HAY AND SILAGE SAMPLES

Samples for fodder analysis must be collected using a corer, not a grab sample from the bale or from the feed out trail. On average, 7-10 bales per lot should be sampled with samples collected from the sides (round bales) or ends (square bales).

Corer holes in silage bales must be sealed with silage tape to prevent air entering.

Silage samples should be refrigerated as soon as collected, then sent by express courier post early in the week. Do not attempt to dry samples in a microwave or oven. Sampling kits and instructions are available at:

FeedTest Lab
Forage Lab Australia
Feed Central

FODDER QUALITY TESTING - KNOW YOUR LABS!

There are two livestock feed quality testing systems used in Australia, both of which measure using NIR (Near Infra- Red spectroscopy).

The two systems are quite different, so do not attempt to compare results using different laboratories. The results from different testing labs will vary, but no lab is better than the other. Each lab regularly (several times/year) ground truths their NIR equation against wet chemistry, so there is good confidence in the validity of the results.

There will also be a +/- 5-10% variance in test readings using the laboratory NIR regression equation, so even if you supplied an identical sample to the same lab at different times there could be a +/- 5-10% variance.

For these reasons, it is recommended you stay with the same lab when testing your hay or silage.

Forage Lab provides more than 30 different nutrient analyses for a standard NIR fodder analysis compared to about 10 for a standard test from FeedTest Labs.



Figure 1. An example of an in paddock silage pit constructed of easily accessible materials such as black plastic and tyres as weights.

The FeedTest Labs results follow the Feeding Standards for Australian Livestock: Ruminants and are reasonably easy to follow, whereas the Forage Lab results are more difficult to interpret, being based on American feeding standards. They do however, provide an explanation sheet covering most of the results.

Forage Lab provides a particularly good NIR silage analysis which includes pH, total VFA (volatile fatty acids), ammonia as % of crude protein and VFA components (lactic acid, acetic acid and butyric acid).

FeedTest Labs don't include silage pH, ammonia as % of crude protein or VFA components in their standard NIR feed test, but they can be requested for an additional charge.

KEYS TO ACHIEVING HIGH QUALITY CONSERVED FODDER

- Cut early
- Wilt quickly

Hay cut early will still deteriorate if on the ground for more than 14 days, especially if rain occurs, as resulting bacterial decay causes significant leaf loss. Results for Eyre Peninsula were unavailable to chart the importance of minimising time on the ground, however differences are evident in hay samples taken from both Kangaroo Island and Fleurieu Peninsula in 2022 (Figure 2).

Silage must be baled or chopped within one to two days of cutting, which is one reason why silage can have higher quality than hay, but hay can be high quality if baled soon after cutting.

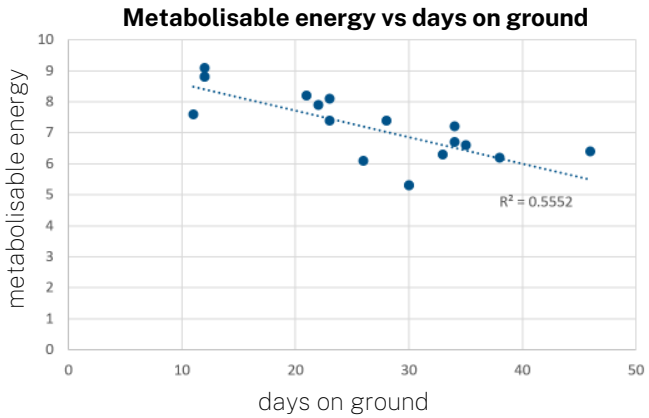


Figure 2. Results from 9 Kangaroo Island ryegrass hay samples, cut mid-October 2022 at early head emergence, plus 7 Fleurieu Peninsula hay samples cut early November to early December 2022. All received between 25 mm and 50 mm rain after cutting.

Tedding a cereal or ryegrass crop significantly reduces curing time by spreading it out (Figure 3). Mowing with a conditioner reduces curing time even further.

To be effective the tedder rake must follow the mower before leaf stomates close.



Figure 3. Tedding a cereal or ryegrass crop significantly reduces curing time by spreading it out.

HAY VS SILAGE COMPARISON

	Hay	Silage
Cost	Good quality baled hay can test the same as good silage and is much cheaper than baled silage, if costed in either $/t dm or c/MJ ME.	Pit/bunker silage cost ($/t dm) is comparable to hay but requires economy of scale e.g. 500 t dm (1,500 wet tonnes). Good quality pit/bunker silage is well suited to fully feeding or maintenance feeding ewes in confinement, but requires specialised equipment therefore economy of scale is important.
Rainfall	Consider baling slightly wetter if it means earlier baling (not recommended with large square bales or high sugar cereals) or use a hay preservative (HayGuard) or hay inoculant (HayKing) which will enable baling at up to 24% moisture. Also consider using a conditioner and tedder to significantly reduce wilting time.	Less likely to be rain affected as only 1-2 days between cutting and baling. Silage can be cut earlier than hay which can allow medic/clover pastures to set seed and remove annual grasses before they produce seed.
Quality	Hay quality varies due to a range of factors. If poor quality hay is on hand it may need to be combined with a higher energy feed source. It is critical to undertake quality testing on both your hay and silage each season to ensure you are meeting your livestock energy requirements.	Silage fermentation will improve fodder ME as volatile fatty acids can be turned into energy in the rumen, but early cutting and quick wilting are still paramount for high quality silage. If fermentation is poor, silage is worthless or even detrimental to livestock due to mould and/or toxins and lack of palatability, and poor silage (ME less than 9.5) is very expensive.
Weeds	Effective way to spread weeds.	Silage will pickle grass and weed seeds but resulting silage may only have a low ME.
Wastage	Hay is easier to feed out, albeit with more wastage than silage. Wastage with good quality hay (ME 10) is very low (maybe less than 15%) compared to poor quality hay (ME 8 upto 50% wastage if fed as the sole ration).	Less wastage than hay (eg 10% compared to 15-50% for hay depending on hay quality) but silage can require specialised equipment to feed out.
Storage	To store effectively, long term infrastructure investment maybe required. Bales can be stored in stacks to prevent weather damage, but you will still incur losses with outside bales. This also exposes the hay to rodent damage/losses.	Silage does not catch fire and there are no mice problems if stored correctly (not in long grass) and not under trees (birds). Pit/bunker silage will last 10-20 years if well sealed, but baled silage will last only as long as the plastic (about one winter).
Transport	Net wrapped hay is easy to transport and well protected from rain.	Silage is difficult to transport once wrapped, or in a bunker or pit.

ECONOMICS OF HAY & SILAGE

Silage round bale wet weight 600 kg.
Contains 45% water or 55% dry matter = 600*0.55 = 330 kg dry matter.

Cost $45/roll (baling and wrapping = $45/330* 1000 = **$136/t dry matter**

Hay round bale weighs 330 kg.
Contains 15% water and 85% dry matter = 330* 0.85 = 280 kg dry matter.

Cost $25/roll (baling) = $25/280*1000 = **$89/t dry matter.**

Pit/bunker silage costs around **$100/t dry matter** (about $30/wet tonne) including chopping, cartage to pit/bunker using a semi-tipper, rolling and plastic.

All costs vary considerably, for example:

- Tube wrapped or in-line silage wrapping is cheaper than individual stretch wrapped bales.
- Heavier bales and drier bales reduce silage cost significantly.
- Self-unloading forage wagons such as Strautmann, Taarup or Krone can be purchased secondhand and are better suited to a smaller scale operation than a self-propelled silage chopper and semi-tippers. Self-unloading forage wagons for making silage can also be used to feed out silage.
- If feeding silage to lambs for maximum growth, a short chop length is important and may also require grain to be added to the silage.
- Silage chop length will be long for baled silage and can also be long with self -unloading forage wagons, compared to self-propelled silage choppers, and therefore may not be suited to production feeding lambs.



Figure 4. Forage wagon unloading silage into a bunker. The forage wagon can also be used to feed out silage. Check carefully for rust and wear/tear if purchasing second hand.

NOTE: As a general rule of thumb, Daily dry matter (DM) intake (% liveweight) = 120/NDF.
For example, a poor hay with an NDF of 60, daily DM intake = 2% liveweight, whereas a high quality hay with an NDF of 40, daily DM intake will be 3% liveweight.

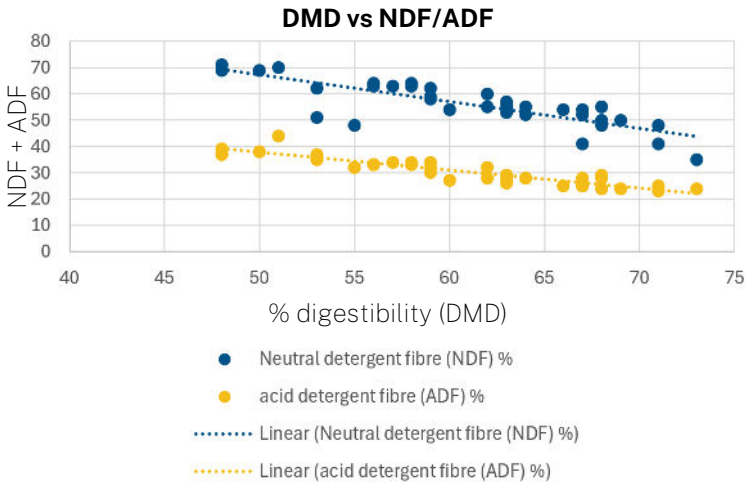


Figure 5. The graph above shows the relationship between ADF and NDF and ME/digestibility for the 35 hay and silage samples collected from Eyre Peninsula in December 2023.

FODDER ANALYSIS TERMINOLOGY

Term	Description
Moisture (water) and Dry Matter (DM)	Dry matter plus water always = 100%. For example, 85% dry matter = 15% water and 65% dry matter = 35% water. All fodder contains water of varying amounts ranging from 10-15% for hay and up to 40-65% for silage and 80-90% for green pasture, but the nutrients are only in the dry matter (after water is removed), therefore fodder analysis results are calculated on a dry matter basis. However, when calculating how much fodder to feed to livestock, you must include water by calculating the "as fed" weight.
Crude Protein (CP)	Nitrogen (N%) x 6.25. Low protein cereal/ryegrass hay is a reliable indication of insufficient nitrogen fertilizer applied during the growing season.
Dry Matter Digestibility (DMD)	The percentage of the dry matter of a feed that can be digested by animals. High digestibility feeds have a DMD over 65-70% which means 65-70% of the feed is used by the ruminant animal and only 30-35% is expelled as dung. Feeds below 50-55% DMD are of poor quality as 45-50% is expelled as dung.
Metabolizable Energy (ME)	The energy content of the feed expressed as megajoules per kilogram of dry matter (MJ ME/kg dm) and is calculated directly from the digestibility.
Acid Detergent Fibre (ADF)	The cellulose and lignin content of a feed. Cellulose is the least digestible form of fibre in a feed whilst lignin is completely indigestible. The lower the ADF, the higher the DMD (and ME). ADF is similar to crude fibre.
Neutral Detergent Fibre (NDF)	Total fibre content of a feed, which includes the cellulose and lignin (ADF) along with digestible fibre such as hemicellulose and pectin. The lower the NDF, the higher the DMD (and ME) and the lower the NDF, the more a ruminant animal can eat. Hay/silage cut too late will have a NDF above 65% (mostly stems). Hay/silage left on ground for too long (or raked too dry) will have a high NDF (and low ME) as most of the leaf has disappeared.
Water Soluble Carbohydrates (WSC)	The total soluble sugars (glucose, fructose, sucrose & fructans) present in fodder. Very high WSC can cause hay to catch fire even if moisture levels are low

REFERENCES & RESOURCES

Top Fodder Silage Manual
NSW DPI - Quality Pasture Silage
South Australian Drought Hub - Livestock & Fodder Management
Dairy Australia - Winter cereal for silage
GRDC - Hay & Silage Factsheet
MLA - What do silage and hay test figures mean

ACKNOWLEDGEMENTS

This project received funding from the Australian Government's Future Drought Fund. Project number DN5_23_01 Filling Feed Gaps: Best Practice Hay and Silage Production. Many thanks to Daniel Schuppan, Nutrien Ag Solutions and Deb Scammell, Talking Livestock for their valuable comments included in this publication.

Prepared by Tim Prance, T Prance Rural Consulting, May 2024.
For further information contact Tim on 0427 812 655 or t.prance@prance.net.au

Australian Government Department of Agriculture, Fisheries and Forestry | Future Drought Fund | SA DROUGHT HUB
T PRANCE RURAL CONSULTING
THE UNIVERSITY of ADELAIDE
AIR EP Ag Innovation & Research Eyre Peninsula
MFMG
SOUTH AUSTRALIAN DROUGHT RESILIENCE ADOPTION AND INNOVATION HUB
This program received funding from the Australian Government's Future Drought Fund

ACKNOWLEDGEMENT

This project is supported by the South Australian Drought Resilience Adoption and Innovation Hub, through funding from the Australian Government's Future Drought Fund.



This program received funding from the Australian Government's Future Drought Fund

DISCLAIMER

Any recommendations, suggestions or opinions contained in these publications do not necessarily represent the policy or views of the South Australian Drought Resilience Adoption and Innovation Hub (SA Drought Hub). No person should act on the basis of the contents of these publications without first obtaining specific, independent, professional advice. The SA Drought Hub and contributors to these publications may identify products by proprietary or trade names to help readers identify particular types of products. The Hub does not endorse or recommend the products of any manufacturer referred to. Other products may perform as well as or better than those specifically referred to. The SA Drought Hub will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in these publications.