Energy and Nitrogen Efficiency in Ruminant Livestock

Reduce emissions through improved productivity in Tasmania

Adrian James, September 2014

Cattle and sheep are the largest source of Australia's agricultural emissions. The key greenhouse gases they produce, methane (CH_4) and nitrous oxide (N_2O) occur through inefficient conversion of feed inputs. Reducing emissions can increase the productivity and profitability of livestock enterprises because more of the energy and nitrogen in feed can be converted into saleable product.

Please discuss these suggestions with your agronomist or livestock nutrition advisor.

ENERGY EFFICIENCY

Only a small portion of total pasture energy intake is converted into meat, milk, offspring or wool by ruminant livestock. Energy is lost by the animal through excrement, burped methane, maintenance of body temperature and tissues, and walking, chewing etc.

Energy availability in the pasture can be maximised through grazing at optimum leaf stage, delaying heading and other measures listed below.

Increase energy efficiency per kg of dry matter intake by:

- Maximising pasture digestibility (keep in vegetative stage etc)
- Maximising energy content of pasture, especially water-soluble carbohydrates (graze at optimum leaf stage)
- Provide shelter to minimise energy used in maintaining body temperature
- Provide some feed with condensed tannins to reduce energy lost as methane and energy spent reducing blood ammonia levels

Increase energy efficiency over an animal's lifetime by:

- For potentially reproductive stock, maximise weaning percentage so that more energy goes to producing offspring relative to daily losses – barren stock are energy wasters
- For terminal stock, maximise weight gain for faster finishing time to reduce total lifetime energy losses

NITROGEN EFFICIENCY

Nitrogen efficiency in Tasmanian livestock is generally lower than for stock on most of the mainland, leading to higher emissions of N_2O and higher losses of nitrate into ground and surface water. This is because ruminant livestock evolved special abilities to internally recycle nitrogen, to help them cope with low-nitrogen feed, but in cool temperate Tasmania, pasture has very high protein (N) levels for much of the year.

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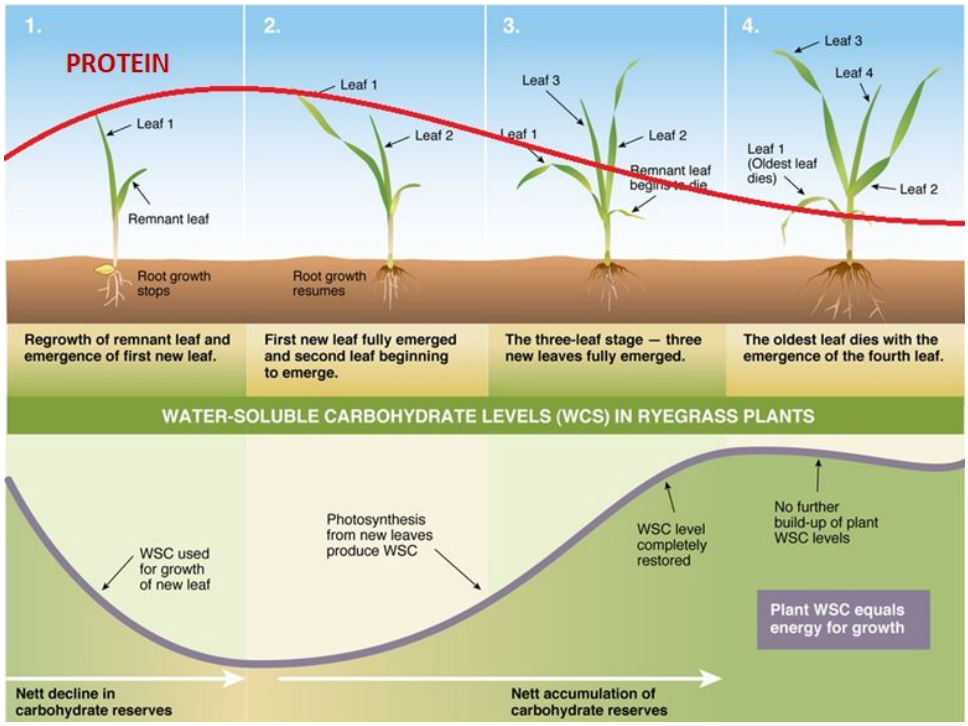
Ruminant stock need different protein intake, depending on class of stock and pregnancy/lactation status. Wethers need around 9%, whereas high producing dairy cows may need 20%. In the cooler months when pasture protein could be as high as 30%, the excess protein decreases livestock performance because there is less energy available per kg dry matter and also because energy is spent converting this extra N into a safe form in the liver. Then the excess N is excreted as urine in high concentration and re-used inefficiently by pasture.

Increase nitrogen efficiency in the livestock by:

- Testing the seasonal protein levels in your pasture and adjusting intake with low-protein supplements as required
- Grazing pasture at the optimum leaf stage for the best energy to protein ratio (Figure 1)
- Providing feed with condensed tannins (e.g. Sulla, Seradella, Birdsfoot Trefoil) to protect protein from degradation in the rumen, and convert more excess N into slow-release faeces rather than high-loss urine. Provide up to 4-6% tannin content per kg of DM.



At the maximum number of growing leaves per tiller, 3 for ryegrass 4 for most others, energy levels are highest and protein levels are lower.

For ryegrass the optimum time to graze is at the 2.5- 3 leaf stage. In mixed swards, assess the species that you want to encourage to be more productive.

Grazing at the optimum stage not only provides the best nutrition (and therefore efficiency) for the animal, but also maximises pasture regrowth.

Figure1: Assessing regrowth of ryegrass pasture for an indication of carbohydrate:protein and the optimal time for grazing (Adapted from Evergraze.com.au). For more information visit http://www.mla.com.au/mbfp/Pasture-utilisation/Tool-36-Grazing-management-methods.

Increase nitrogen efficiency in the pasture by:

- Using legumes where possible for slow-release nitrogen
- If adding nitrogen fertiliser be careful to minimise losses by not using more than the plants need, using liquid fertilisers and minimising volatilisation from urea
- Manage soil moisture to minimise N losses through waterlogging or deep drainage
- Maximise pasture rooting depth to capture deep soil N
- Reduce impediments to pasture growth such as weeds, compaction, nutrient limitations and soil acidity