How to get the best value out of forages

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Forages play a major role in feeding ruminants because they provide necessary physically effective fibre which is the basis for good rumen health. In contrast, concentrates are feeds with highly digestible components and very little effective fibre. They supply a lot of energy per kgDM which can be useful to achieve higher yields but they need to be fed in combination with forages. We want cows to consume high energy intakes; therefore forages should not only supply effective fibre but also high ME which only can be achieved through a combination of not too high fibre levels and good digestibility. There is a conflict in goals for defining targets for forages: we want forages to supply enough physically effective fibre but not excessive fibre levels because high fibre levels are negatively correlated to high ME concentration in feeds. A good balance between both is what defines good forage quality. The economic value of forage quality can be estimated by using the potential milk production based on ME delivered per tonne of DM. The example in slide 6 shows a difference of 25kgMS/tDM between a low and high quality pasture silage.

The main factors to influence forage chemical composition (DM, NDF, ADF, starch and crude protein) are time of harvest and harvest process. **Pasture** silages grow more mature and increase yield over time. Data on slides 10-14 show increased yields from 2 to nearly 6 tDM/ha with a simultaneous decrease of ME from 12 to 10.3 MJME/kgDM and crude protein from 20.9 to 10.4 %DM when harvested 3 to 9 weeks post closure; in other words: with increasing yield, quality went down and a good balance has to be found between yield and quality. Harvest ideally before grass goes to seed head. Target values for quality of pasture silage are on slide 33. The silage harvest process influences DM% and fermentability of grass: Choosing the best weather conditions to cut grass and length of wilting period before harvest will determine the amount of water evaporated i.e. DM%, sugar levels and ash (too high ash = dirt) in the harvested material. These are the main drivers for the quality of the resulting silage. See also Trish Lewis' presentation.

Cereal silage quality is strongly influenced by harvest time and cutting height. It is recommended to either cut at early vegititative stage (flag leaf-boot stage) and wilt or at milk-dough maturity. Late harvest will lead to kernels that will not digested adequately and yellow stems that are difficult to compact. Cereal silage at dough stage have a risk of butyric acid fermentation due to low nitrate levels which can be mitigated through the use of a proven inoculant and heating at feed-out because compaction can be difficult with hollow stems.

Maize yields and plant composition changes significantly in the last weeks before harvest. With increasing maize ear growth DM yields and starch levels go up. The optimum dry matter at harvest is around 35%; this is a good balance between utilizing the full yield potential and best quality – high starch and ME – without risking an overly dry crop beyond 40%DM with potential problems in compacting maize in the stack and subsequent heating after opening (slides 23-25). It is important to process maize kernels well at harvest to avoid fecal starch losses. A new standard the 'Corn Silage Processing Score (CSPS)' has been established as a laboratory method. The results reflect how much of the starch % in a chopped whole plant maize sample passes through the coarse screen of a lab screening tool called Rototap. NZ field monitoring demonstrated that CSPS improved in the last years due to more attention to detail by contractors and improvements harvest equipment manufacturers introduced (Slides 26-28). Chop length of maize silage affects physically effective fibre (peNDF). US guidelines for peNDF in Total Mixed Rations (TMR) rank maize silage at 0.8-0.85 for short (6-13mm) to medium (13-25mm) theoretical chop length. In comparison long hay has a factor of 1.0. Although maize silage contributes to peNDF in diets it is still recommended to introduce it slowly to avoid rumen health problems especially in combination with high quality pasture. Slide 30 highlights the effects of stack compaction and feed-out rate on oxygen penetration into the silage face. Substandard compaction (<200kgDM/m^3) and slow feed-out rate (<1.5m/week) will increase the risk of heating. Good stack management including using a proven inoculant that prevents heating is essential to keep losses down. See also Trish Lewis' presentation.

Benchmarks for grass and maize silage quality in slides 33-35 show the difference between ‘nutritive value’ mainly driven by harvest date and ‘silage quality’ which describes how well the plant material fermented.