

## **Securing forage availability in a changing climate**

- Strategies to manage poor supply and quality of ley crops in cattle production.

Forage is essential in ruminant diets and securing forage supply is one of the most important tasks in ruminant livestock production. In a changing climate, variation in forage availability and quality is expected to increase and therefore, strategies to manage situations with insufficient supply is warranted.

Ley crops, grass and legumes, are the dominating forage source in Sweden and in several other parts of the world. The yield of ley crops is generally reliable and vary between 12 and 15% under Nordic conditions. In extreme weather, the variation may be larger and during the drought in 2018, the yield of ley crops in the south of Sweden was no more than 60% of normal harvest. Some crops that are not intended for forage can in situations of forage shortage step in as alternatives. Cereals for grain production can be used as forage when the whole plant is harvested before it is ripe. We developed a growth model that predict yield and quality of spring barley as a tool for harvest planning in situations when ley crop yield is expected not to cover the total forage demand.

Wild vegetation is another alternative when forage crop yield is limited. Reed is a fibrous plant that grow in dense populations in water and on the shoreline of lakes and sea. We have studied reed and conclude that it is possible to ensile, despite its low sugar concentration. We have found that reed silage can be used as the sole feed for dry dairy cows but that its fibrousness and low digestibility restrict heifers to consume enough to fulfil their energy requirements. We also evaluated bi-products from the wood industry as replacement for common forage. In cow experiment we have fed milled bark and wood of aspen and have seen that the cows eat it but that the digestibility is low.

Alternatives to cultivated forage crops are usually more fibrous with lower digestibility, which restrain feed intake. A way to increase intake is to reduce the feed particle size. We have evaluated a mechanical treatment, bio-extrusion, aimed for the biogas industry, where screws shear and grind the material under pressure. By this treatment, we have seen increased intake of silage from late harvested ley crops in dairy cows and increased intake of reed silage in dairy heifers.

In the research described above we have investigated different ways of overcoming shortage of forage. The extreme examples might not be of use other than in extreme situations but the purpose has been to show opportunities rather than practical solutions. Future work in this area will include evaluations of alternative crops that are more resistant to extreme weather than the common forage crops used today and development of treatments that can improve their feed value. It should also include systems analysis to evaluate how crop tolerance to drought and flooding, crop yield, feed value and animal performance can be optimised to accomplish resilient cattle production systems in the future.