

### **SmartGrass: Herbage production and conservation efficiency when grass monocultures or multi-species mixtures are managed for silage production (RMIS 6456)**

Due to agronomic qualities such as high yield, early spring growth, high digestibility and the ability to recover from defoliation, perennial ryegrass is the focus of most grassland productivity based research. However, it needs high nitrogen inputs in order to achieve high productivity, and further increases in its yield potential may take some time to develop.

Multi-species grassland swards offer the potential for 'smart, green growth' where we take advantage of the opportunity for transgressive over-yielding and increase agricultural output in a sustainable manner. A modest number of studies have shown that biomass production is positively related to increased species diversity within the sward and particularly where these species are from different functional groups. This is believed to be due to niche complementarity.

Both quantitative and qualitative changes occur during silage-making and feedout. The overall efficiency of this process is the product of a number of constituent changes but particularly those associated with fermentation, effluent production and respiration. Previous research has shown that monocultures of individual grass species differ in the ease with which they undergo a lactic acid dominant fermentation and it is assumed that the ensilability of mixtures of these species could be predicted based on the contribution of each species to the mixture. However, because of the differences in herbage architecture (and thus the extent to which solar ultra-violet radiation can access much of the lower canopy of the crop) for a sward of mixed botanical composition compared to a monoculture, the indigenous epiphytic microflora may differ between a mixed species sward and a calculated value based on monocultures. This could alter the subsequent fermentation process. Furthermore, clear information is not available on how herbage species impact on effluent production or on subsequent aerobic stability when silage is exposed to air. A difference in silage aerobic stability between legumes and maize was previously demonstrated, and it is likely that this difference exists between clovers and temperate grasses. Consequently, although mixtures of grasses and clover(s) may be more difficult to preserve than a monoculture of perennial ryegrass, such mixtures may be aerobically more stable. This has important practical implications since aerobic deterioration normally accounts for the largest component of overall conservation losses.

The aims of this project are to

1. Compare seasonal and annual herbage production for a number of monocultures, binary mixtures and multi-sward mixtures.
2. Quantify the yield, botanical composition, nutritive value and ensilability responses of these swards to a series of rate of inorganic N fertiliser.
3. Quantify the impacts of the timing of the completion of spring grazing (i.e. number of sequential spring grazings) on sward yield and nutritive value when subsequently harvested for silage.
4. Describe how the yield and composition (chemical, phenological and botanical) of the primary growth of the various swards change during May and June.
5. To quantify any carryover effects of these management options on subsequent silage harvests and on annual production.
6. Determine the effects of sward type and the other management factors on the efficiency of the ensilage process

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