**Effects of sward species diversity on pasture productivity and botanical composition under intensive grazing with dairy cows**

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**Application:**

Legumes and herbs incorporation in grazing swards can be an answer to reduce chemical N inputs while maintaining sward productivity.

**Introduction:**

As part of the management of intensive grazing systems, the focus on simple and productive forage systems has led to a limited range of plants being used in grazing swards which are predominated by *Lolium perenne* L. (perennial ryegrass - PRG) monocultures. Such swards are capable of high levels of productivity and nutritional value (Baker et al., 2023) but are reliant on high levels of mineral fertilizer application and adequate moisture availability (Grange et al., 2021). Such systems are increasingly questioned due to their negative impacts on the natural environment both in terms of agricultural greenhouse gas emissions and nutrient losses to air and water (Delaby et al., 2020).

The inclusion of legumes such as *Trifolium repens* (white clover - WC) within grazing swards has received much attention in recent years to reduce dependence on chemical nitrogen (N) fertilizer application. More recently, a growing body of scientific evidence has shown that the inclusion of additional dicotyledonous such as chicory (*Cichorium intybus* L.) and plantain (*Plantago lanceolata* L.), can improve both productivity and sustainability and improve the overall resilience of grazing systems (Grange et al., 2021; Baker et al., 2023). However, much of the evidence has been derived from short-term (3 to 6 month) evaluations, and few of them with grazing animals. This may not reflect the longer term performance within intensively managed grazing systems. On that basis, the objective of this study was to evaluate the performance of PRG-WC and multispecies swards in a farmlet scale systems experiment with grazing herds.

**Material and methods:**

The experiment was a randomised block design with three sown swards: a monoculture of PRG, a classical association of PRG and WC (PRG-WC) and a multispecies sward (MSS) composed of grasses, legumes, plantain and chicory. Overall, 3 farmlets of 18.7 ha were created, each divided into 20 paddocks. Paddocks for each treatment were balanced for location, soil type, and soil fertility throughout the farm. During the trial, the PRG sward received 250 kg of chemical N ha-1 yr-1 while the PRG-WC and MSS received 125 kg. Total net herbage production, botanical composition and chemical composition were measured over the years 2021 and 2022. These data were analysed for sward, season and year effect using mixed linear models (Proc Mixed, SAS Institute, 2006).

**Results:**

There was no significant difference in annual herbage yield between the three swards systems during the two year study (13.3, 12.5, 13.2 t DM ha-1 for PRG, PRG-WC and MSS, respectively) despite large differences in mineral N application. Botanical composition of the PRG monoculture was 995 g/kg grasses and 5 g/kg of unsown species, on average over the two years. In comparison the PRG-WC sward had, 836, 163 and 1 g/kg of grasses, white clover and unsown species respectively while MSS had 673, 151, 171 and 5 g/kg of grasses, clovers, herbs and unsown species respectively. There was no significant effect of sward system on sward nutritive parameters (CP, NDF or ADF contents of 220, 403 and 207 g/kg DM, respectively), nor was there any significant year effects, or interactions between sward system and either season or year. The effect of sward system on ash content was greater for MSS (114 g/kg DM) compared to both PRG and PRG-WC (97 and 102 g/kg DM, respectively). Relatedly, OMD content approached significance (P<0.10) and tended to be lower for MSS (799 g/kg DM) compared to both PRG and PRG-WC (812 and 808 g/kg DM, respectively).

**Conclusion:**

This study confirmed the findings of previous component based evaluations (Baker et al., 2023) and indicated that the inclusion of legumes and herbs within intensively managed grazing swards can yield similar DM production and nutritive characteristics to traditional PRG swards, while substantially reducing requirements for chemical N fertilisation. Further evaluation of such swards within longer-term research platforms is required to evaluate the persistency of the species and to enhance successful adoption of both PRG-WC and MSS systems.

**Acknowledgements:**

The authors would like to thank Moorepark farm and staff for the help in data collection and processing. The authors would also like to acknowledge the support of the Teagasc Walsh Scholarship scheme and University College Dublin.

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