

Yield stability of multi-species mixtures for silage grass in boreal conditions

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Introduction

This study aimed to quantify the effect of increased plant diversity on dry matter yield and forage digestibility (D-value), while tracking changes in species composition over four years (2021-2024) in Finland.

Material and methods

Species diversity treatments

- Low diversity (LD): 2 species
- Moderate diversity (MD): 5 species
- High diversity (HD): 14 species

Experimental design

- Sown in 12 m × 50 m strips
- Two replicates with four pseudo replicates

Management

- 2-3 cuts per year
- Decreased N fertilizer application for leguminous mixtures
- Slurry application after 1st cut

Measurements

- Dry matter yield
- Botanical composition
- Forage digestibility (D-value)

Results

Yield

The four-year cumulative yield of LD and HD mixtures was significantly higher compared to MD (Figure 1).

Yields between years and cuts varied significantly in all mixtures.

In 1st cut the D-value of HD was significantly lower compared to LD and MD in all years.

In 2nd cut the D-value of HD was significantly lower compared to LD in 2022 and in 2023.

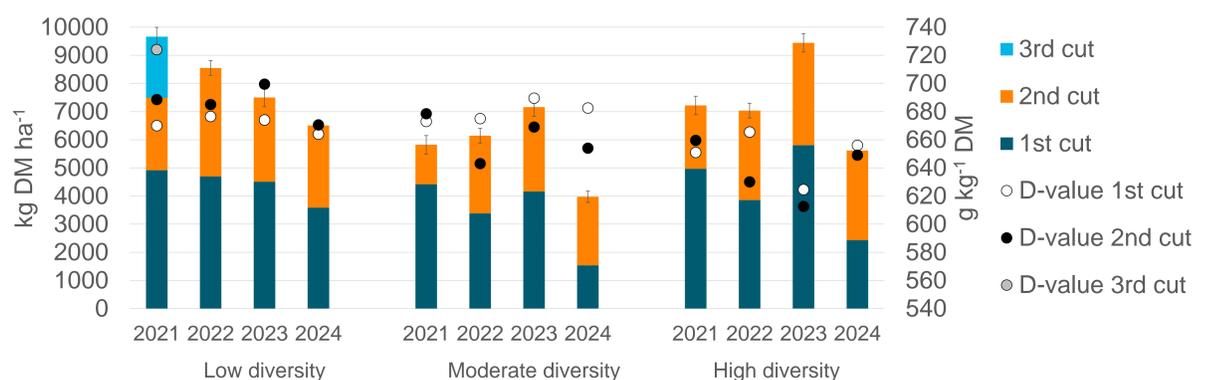


Figure 1. Dry matter yield (kg DM ha⁻¹) and digestibility (D-value, g kg⁻¹ DM) of mixtures with low, moderate and high species diversity at 1st, 2nd and 3rd cut in years 2021-2024. Standard errors of the mean (SEM) are presented for DM yield of total yield, n = 2. SEM (year × treatment) of D-value was 12.8 in 1st cut and 7.8 in 2nd cut.



Figure 2. Moderate (a-b) and high diversity (c-d) mixtures at first cut in 2021 (a,c) and 2024 (b,d).

In the fourth year, alfalfa and orchardgrass dominated the high-diversity mixture, while red clover winter damage reduced the yield of the moderate-diversity mixture.

Botanical composition

Species composition varied over years and cuts.

Seven species contributed each more than 5 % of the total DM yield in the mixtures in at least one cut throughout the experiment.

Five species contributed less than 1% throughout the study.

Weed proportions increased with low and moderate species diversity, reaching 43% in LD and 45% in MD at the final cut.

Conclusions

The results indicate that high species diversity at sowing does not always enable high species diversity in production years.

Aggressively growing species (in this study *Medicago sativa*, *Dactylis glomerata*) can

- 1) effectively suppress weeds and extend the length of grass rotations
- 2) reduce the species diversity
- 3) reduce forage digestibility

In practice, cultivation of multi-species mixtures may lead to challenges related to unpredictable yield quantity and quality.