

Optimising boreal grassland production through species selection, nitrogen management, and harvest strategy



Termonen, M., Louhisuo, A., Korhonen, P. and Kykkänen, S.
Natural Resources Institute Finland (Luke)

Introduction

We tested effects of five commercial grass seed mixtures on species composition, yield quantity and nutritional quality under various harvest and fertiliser application strategies. The aim was to find practical solutions for farmers to optimise cultivation strategies.

Table 1. Grass mixtures (G1, G2 and G3) and grass-legume mixtures (L1 and L2) and their composition (species and cultivars), per cent (%) of sowing mixture (25 kg ha⁻¹, except G2 30 kg ha⁻¹).

	<i>Phleum pratense</i> (TIM)		<i>Festuca pratensis</i> (MF)		<i>Festuca arundinaceae</i> (TF)	<i>Lolium perenne</i> (PRG)	<i>Trifolium pratense</i> (RC)	<i>Trifolium repens</i> (WC)
Mixture/cultivar	'Tuure'	'Rhonia'	'Klaara'	'Eevert'	'Karolina'	'Riikka'	'Selma'	'Silvester'
G1 'Tuurenurmi'	75		10		15			
G2 'Mehevä'	35	40	25					
L1 'Laatu'	36	24	10			10	15	5
G3 'Tuottava'	35	25	20		10	10		
L2 'Mahtava'	20	40		10	10	10	10	

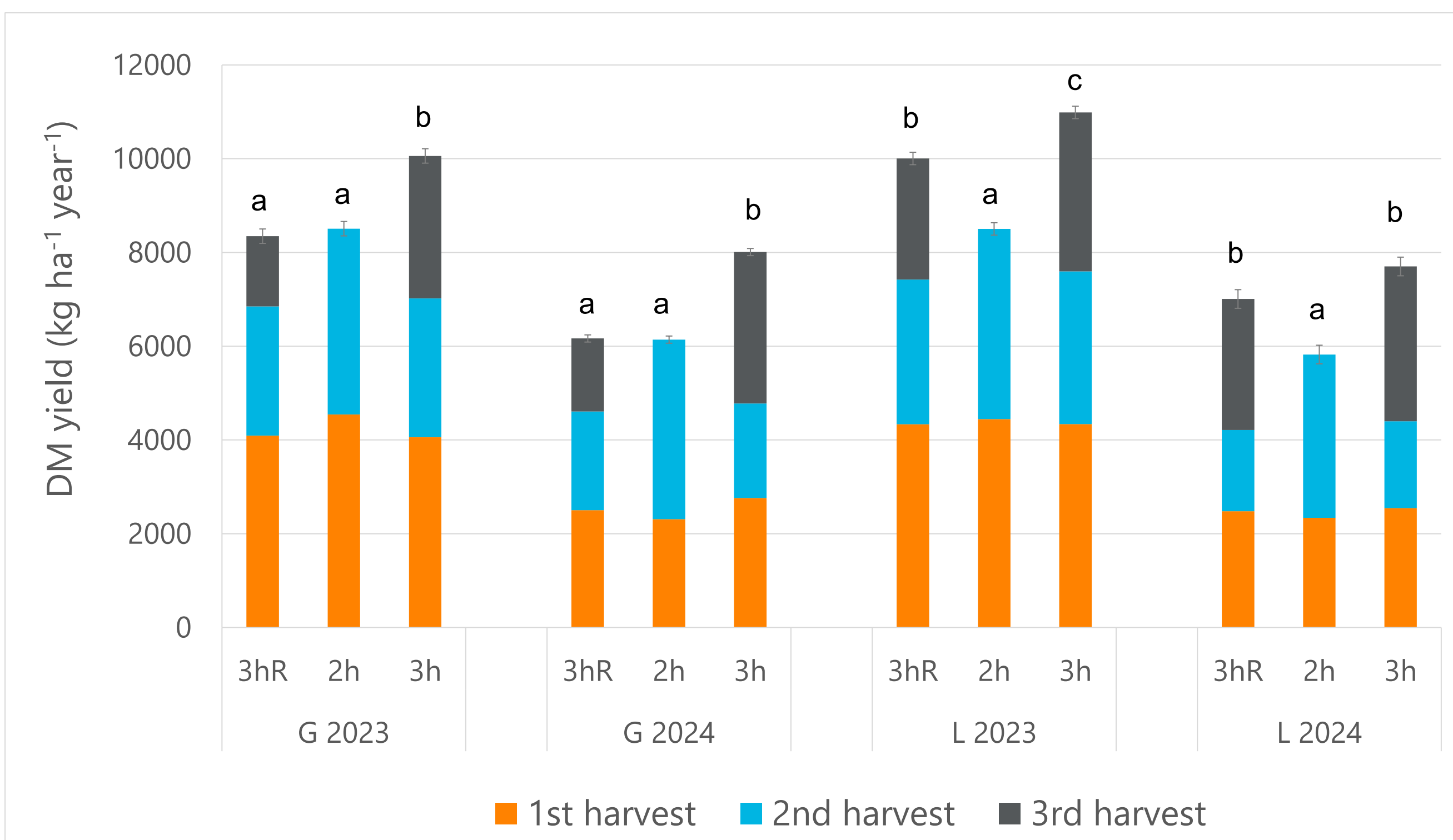


Figure 1. Dry matter yields (DMY) of grass mixtures (G) and grass-legume mixtures (L) in 2023 and 2024. 3hR = three harvests with reduced nitrogen (N) fertiliser application, 2h = two harvests with maximum N, 3h = three harvests with maximum N. Means marked with different letters indicate statistically significant differences ($P \leq 0.05$), G, L and years separately. Error bar is the standard error of the mean (SEM).

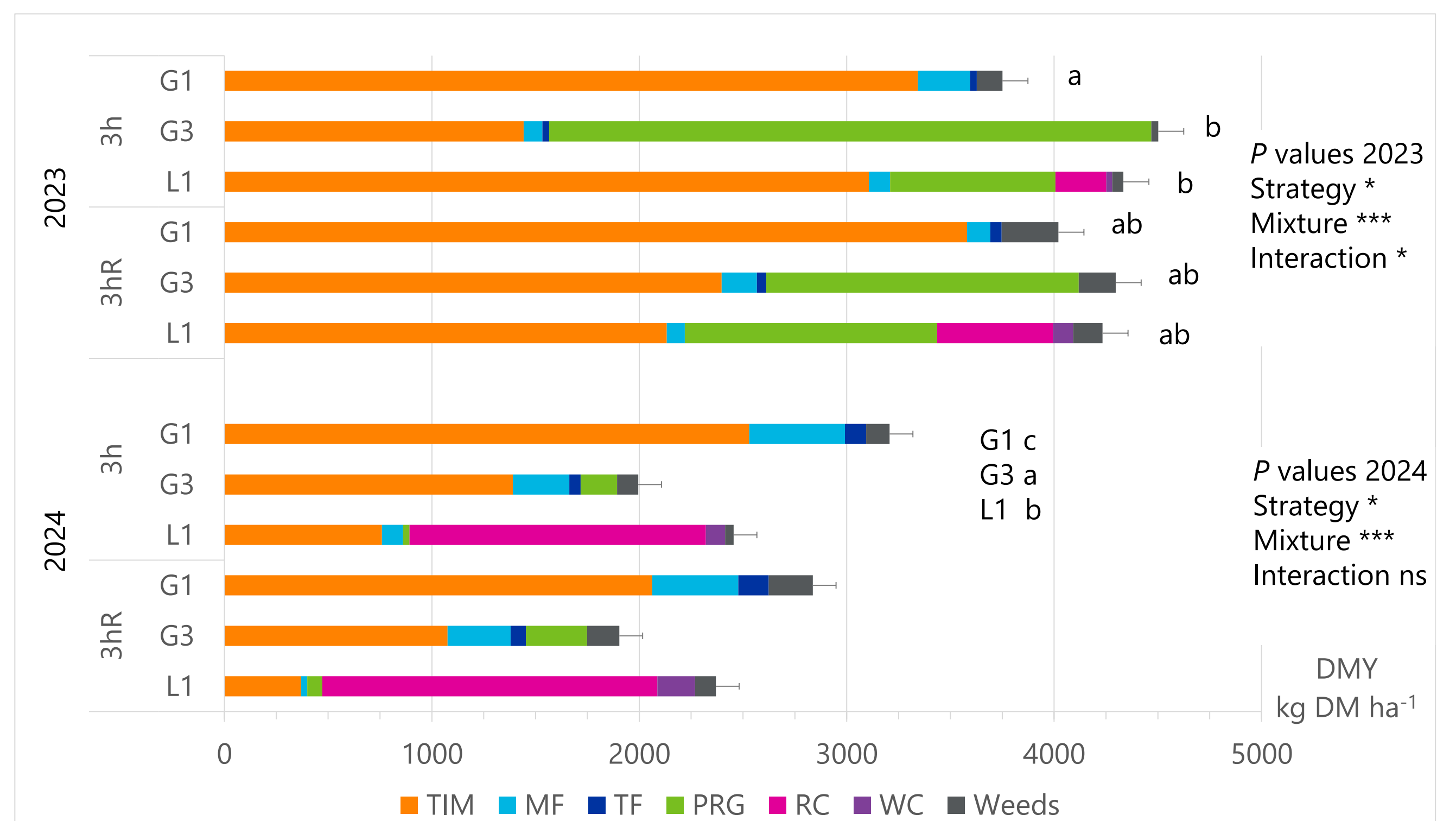


Figure 2. Dry matter yields (DMY) and botanical composition of grass mixtures (G1 and G3) and grass-legume mixture (L1) in the first harvest in 2023 and 2024 with cultivation strategies 3hR (three harvests with reduced nitrogen (N) fertiliser application) and 3h (three harvests with maximum N). Means marked with different letters indicate statistically significant differences ($P \leq 0.05$), years separately. Error bar is the standard error of the mean (SEM). *** ($P < 0.001$), ** ($P < 0.01$), * ($P < 0.05$), ns ($P > 0.10$).

Material and methods

- East-central Finland, 2023–2024, mineral soil (sandy loam)
- Three grass mixtures (**G**) and two legume-grass mixtures (**L**) (Table 1) with three cultivation strategies and three replicates

3hR: 3 harvest, reduced N (70 + 90 + 0 kg sol-N ha⁻¹)

2h: 2 harvests, maximum N (100 + 93 kg sol-N ha⁻¹)

3h: 3 harvests, maximum N (100 + 83 + 60 kg sol-N ha⁻¹)

All strategies included cattle slurry injection for 2nd cut (30 t ha⁻¹)

- Dry matter yield (DMY), nutritive values and botanical composition were measured.
- Herbicide (active ingredient amidosulfuron) for the 2nd cut in 2024.

Finding optimal strategies requires selecting winter-hardy species and management practices accounting for the legume component.

Results

- As only minor differences were detected among the G1–G3 mixtures and the L1–L2 mixtures, the results in Fig. 1 are presented as averaged values for the two mixture types.
- With the G-mixtures, the highest DMY was achieved with three harvests and maximum N (G3h; Fig. 1). With L-mixtures, reduced N (L3hR) produced higher DMY than L2h in both years and the equal DMY with L3h in 2024. However, this logical result appeared only in the 3rd harvest.
- *L. perenne* suffered winter damage, causing a sharp decline in DMY in the 1st harvest of 2024 (Figure 2).
- The 2nd year was favourable for *T. pratense* (Figure 2). The amount of it in the 2nd harvest in 2024 was low (4 %) due to herbicide use. However, the relative abundance recovered to 31 % in the 3rd harvest of L3hR.

Conclusions

- The strategy of three harvests instead of two, and N fertiliser application also for the 3rd harvest, is recommended for attaining the highest DMY.
- The benefits of biological N fixation by *T. pratense* might have been more pronounced under lower N fertiliser application and without herbicide.



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Contact: maarit.termonen@luke.fi

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