



Impact of nitrogen source, application method, and dose on red clover-grass ley in boreal conditions



Sanna Kykkänen, Maarit Termonen, Arja Louhisuo, Panu Korhonen and Perttu Virkajärvi
Natural Resources Institute Finland (Luke)

Aim

To increase the cultivation of red clover in northern regions, its cultivation reliability must be improved under hard winter conditions. We investigated the yield response of red clover-grass mixtures to different N fertiliser application methods, and N-rates, using the latest commercially available varieties.

Material and methods

- The **field study**, conducted in central Finland 2023-2024 on mineral soil (sandy loam) with 6.3% organic matter content
- Mixture of timothy (50%), meadow fescue (25%) and **red clover (25%)**
- Three cattle slurry application methods as **mainplots**
 - injection
 - trailing hose
 - solid fraction of slurry
- Mineral N as a **control strategy**
- Soluble N (sol-N) rate as **subplot**
 - 0N kg N ha⁻¹ cut⁻¹
 - 50N kg N ha⁻¹ cut⁻¹
 - 100N kg N ha⁻¹ cut⁻¹
- Measured variables were **winter damage, dry matter yield and red clover content**

Results

The amount of soluble N in fertilisers significantly increased yield level and decreased clover content. The insoluble N from slurry had no effect on either clover content or yield.

- The effect of sol-N fertiliser application on total DM yield was primarily driven by yield increases in the 1st cut with lower clover content

The yield response to N fertiliser application clearly declined from the 1st cut to the 2nd cut and from the first to the second year.

The slurry application method had

- a minor effect on DM yield in 2023
- no effect on red clover content in both experimental years, despite higher total N input in the manure-treated plots

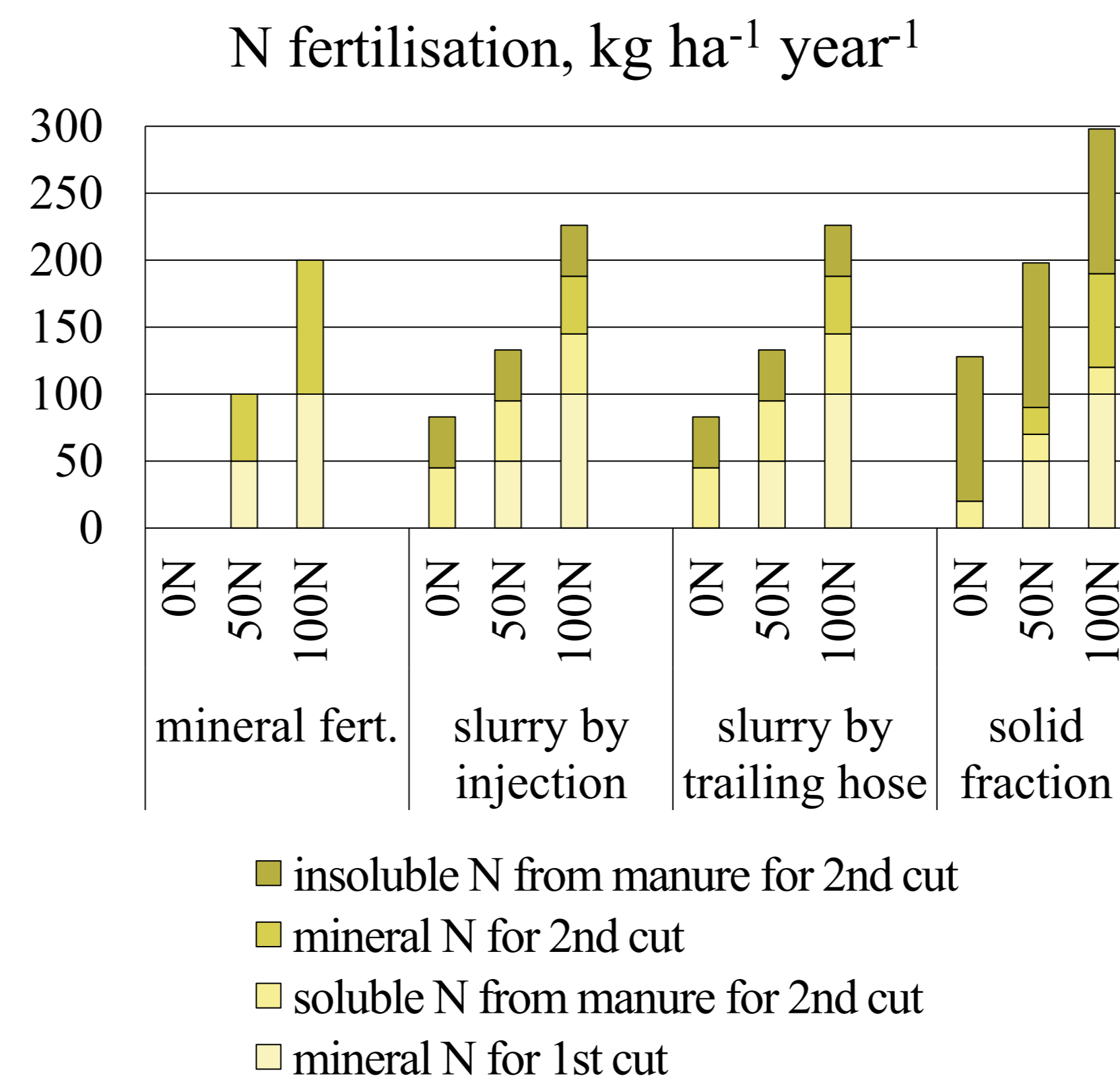


Fig 1. The amount (kg ha⁻¹) of soluble and insoluble nitrogen (N) from mineral and manure sources in the three soluble N treatments (0N, 50N and 100N kg sol-N ha⁻¹ cut⁻¹) and in four application methods in 2023 and 2024.

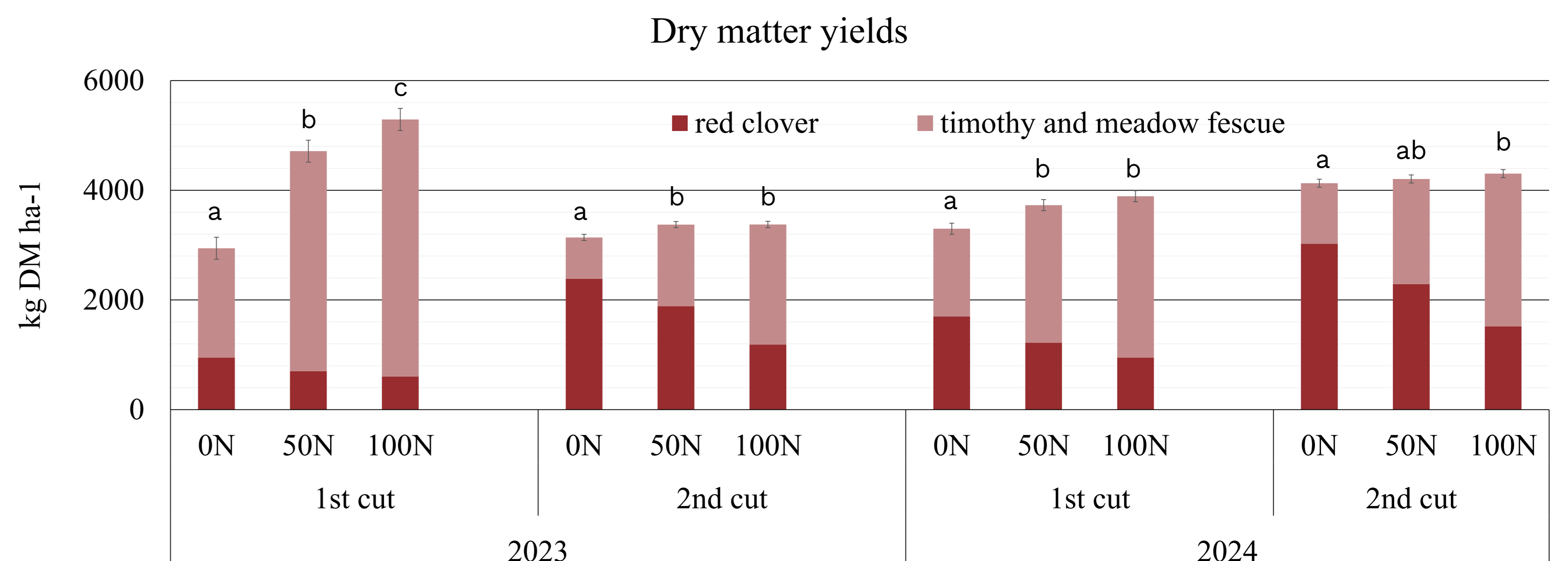
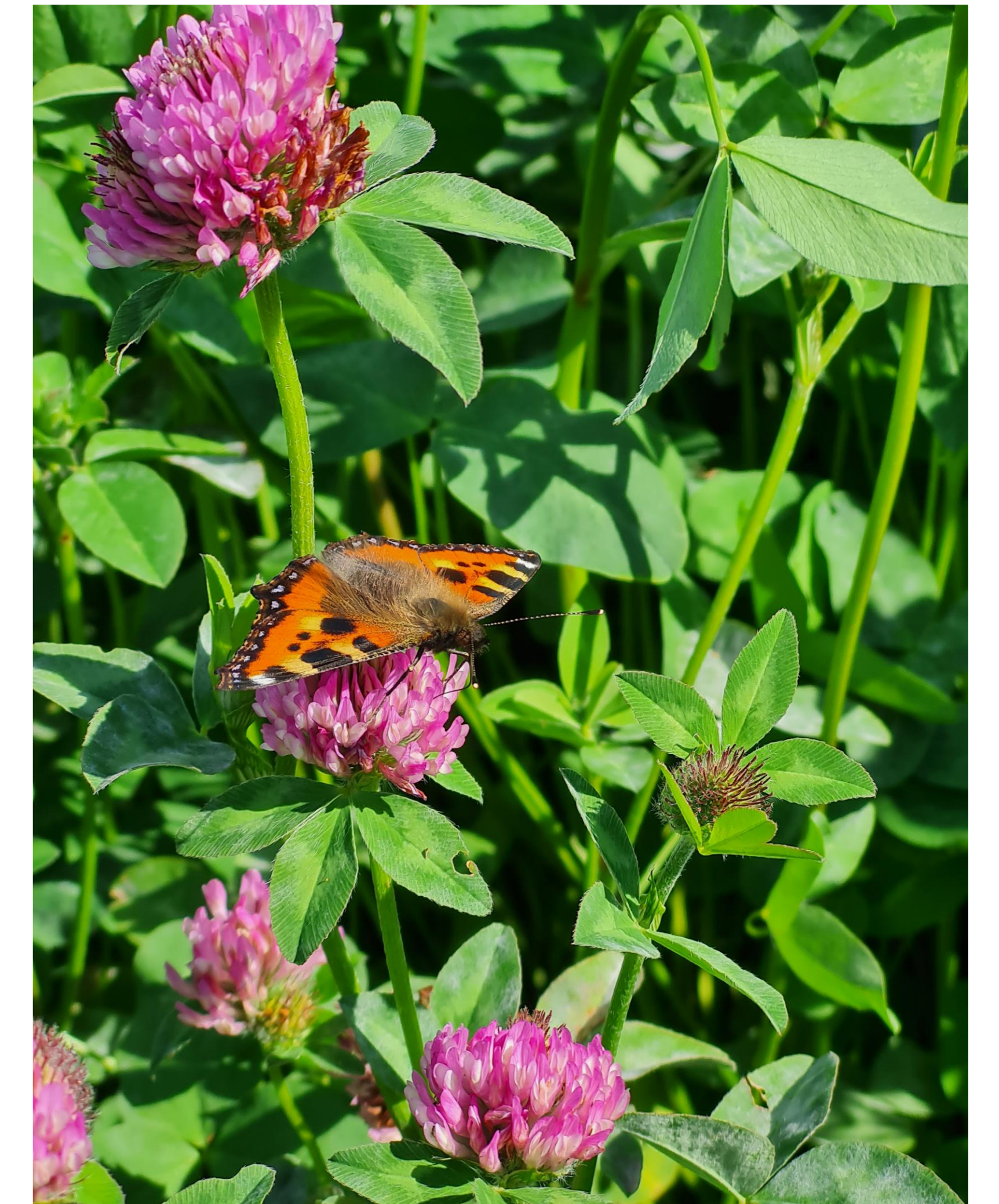


Fig 2. The average dry matter (DM) yield in each soluble nitrogen (N) fertiliser treatment (0, 50 and 100 kg sol-N ha⁻¹) in 1st and 2nd cut over all application methods in 2023 and 2024. Different letters above columns indicate statistical difference ($P < 0.05$) between N treatments on each year and cut. Error bars represent the standard error of mean of total DM yield in each cut.

Conclusion

50 kg ha⁻¹ of soluble nitrogen per cut in the form of cattle manure or mineral fertiliser was sufficient for fertilising clover-grass ley.

Despite severe third-winter (2024-2025) damage to red clover, total annual yield was maintained, likely due to a red clover pre-crop effect. (data not shown)

