THE EFFECT OF MANAGEMENT ON PROTEIN YIELD, EXTRACTABILITY, AND QUALITY FROM PERENNIAL GRASSES CULTIVATED ON A RIPARIAN FEN

AARHUS UNIVERSITY
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BACKGROUND AND METHODS

Biomass:

- Six different treatments (cut frequency and fertilisation)
- Two different species
- Two years

Protein extraction:

- Juicing and precipitation of protein using lab-scale biorefinery techniques
- Crude protein classification (quality) of Biomass using CNCPS*
- Correlation of CNCPS and protein extraction by biorefinery

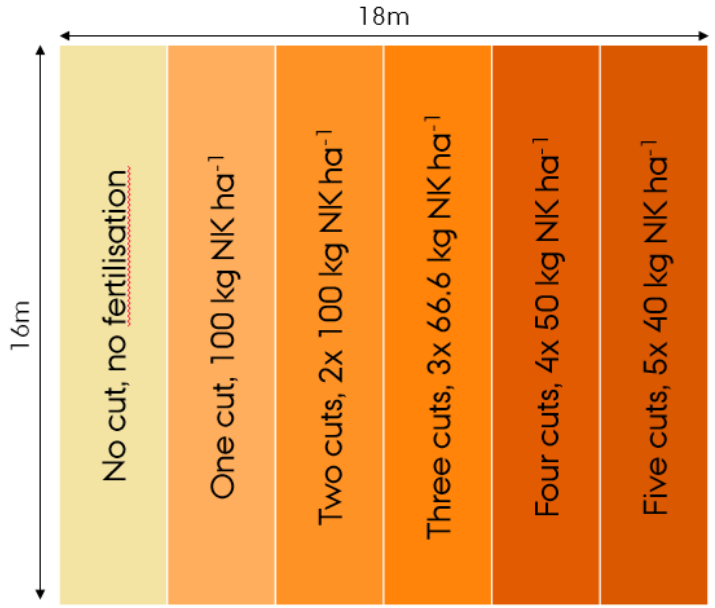

Fig. 1: Experimental design of subplots

Fig. 2: Lab-scale screw-press

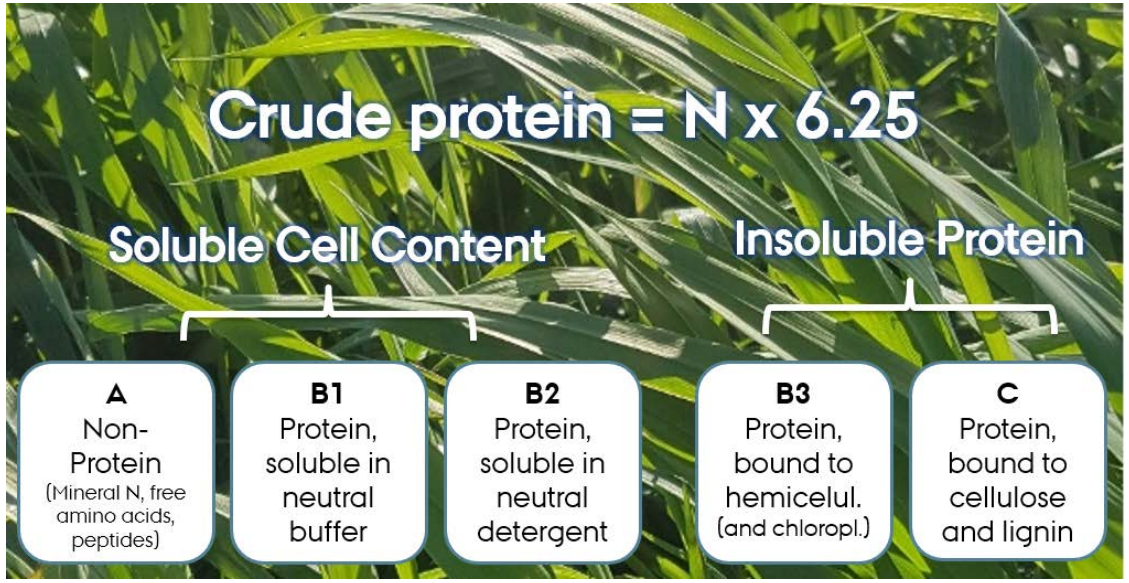

Fig. 3: *Cornell Net Carbohydrate and Protein System, as displayed

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CRUDE PROTEIN YIELD

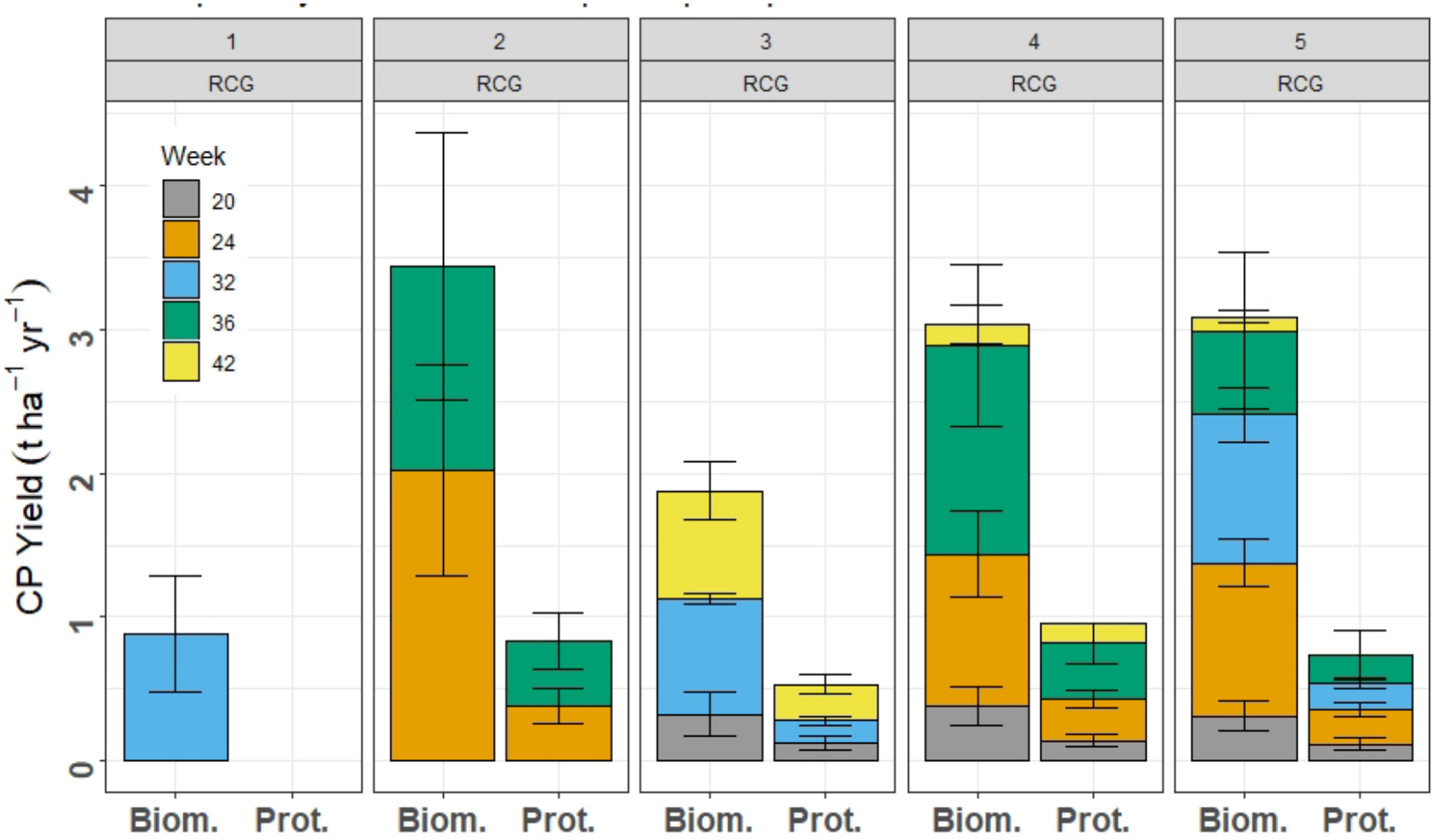

Fig. 4: Annual crude protein (CP) content (yield potential) in biomass, and in the by biorefining precipitated protein paste CP yield, in t ha^{-1} yr^{-1}. All yields in DM.

- The potential annual CP yield in biomass was with 3.4 (± 1.7) t ha^{-1} yr^{-1} highest in the RCG two-cut treatment.
- The potential, by biorefinery, extractable CP yield for the grasses was with 1.0 (± 0.3) t ha^{-1} yr^{-1} (RCG, four-cut) only insignificantly higher than in the two-, or five-cut* scenarios.
- On a share basis are CP contents lowest in summer cuts.

*Juicing in week 42 missing due to deficient biomass input

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CRUDE PROTEIN QUALITY

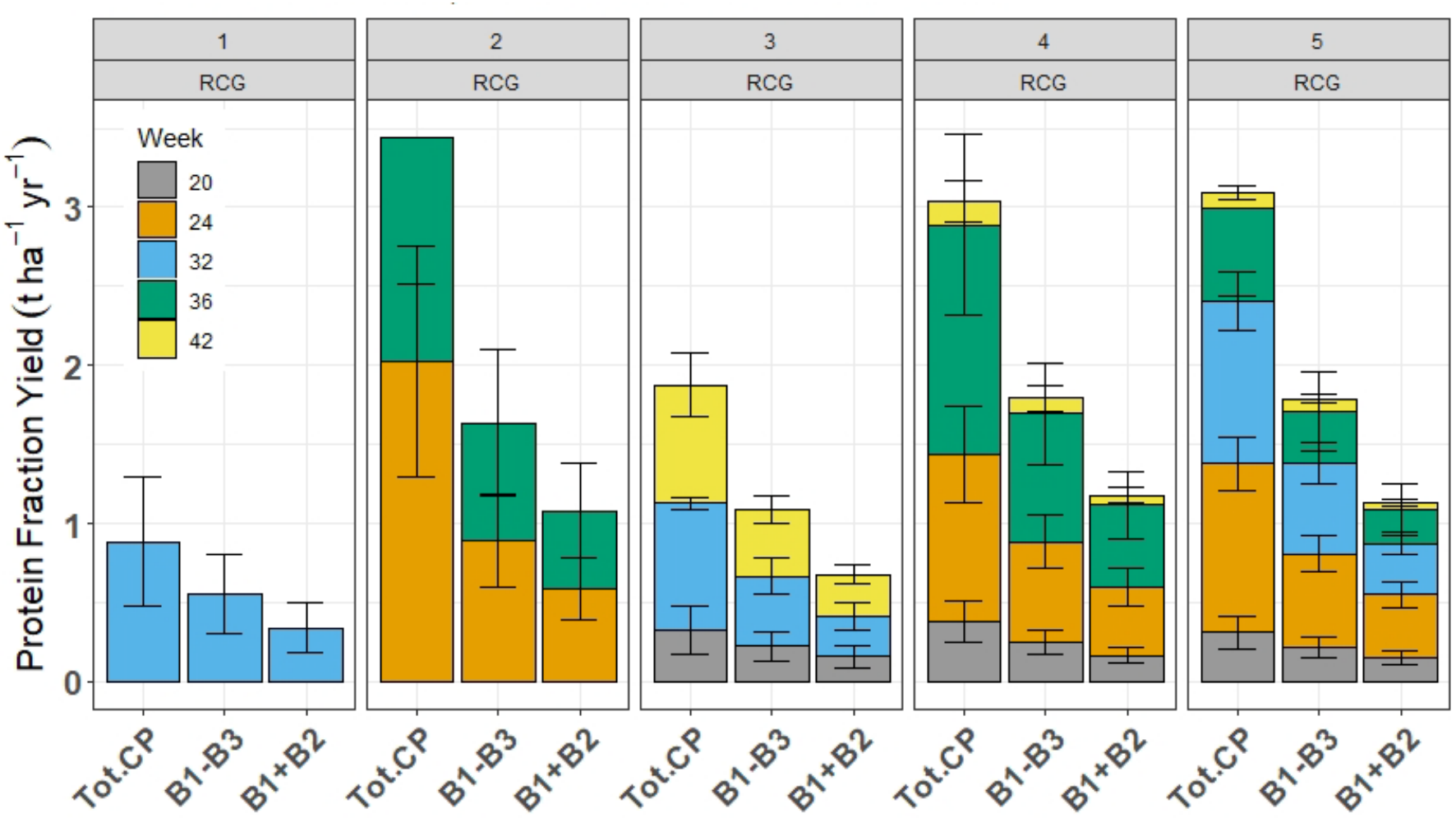

Fig. 5: Annual protein fraction yield (DM) in biomass (t ha^{-1} yr^{-1}) according to CNCPS. B1 and B2 are neutral extractable proteins. The cellwall-bound fraction B3 is conditionally extractable using acids. Yields in DM.

- The average yield of B1 and B2 fractions was highest in RCG treatments 2, 4 and 5 (1.1–1.2 (± 0.3-0.5) t ha^{-1} yr^{-1}).
- Across all treatments and harvests, in average 35.5 % to 55.5 % of the total biomass CP are fractions B1 and B2. With an additional extraction of B3, this would increase to 54.6 % to 89%.

TAKE HOME MESSAGES

- Biomass yield is highly dependent on soil properties, whereas protein yield and quality is determined by an interaction of cut dates, frequencies and environmental variables.

- From both, an environmental perspective, as well as labour input, the two-cut treatment seems to be the most viable management option, providing both: sufficient yield and quality of the proteins.

- Proteins from perennial grasses cultivated on wet peatlands have the capacity to compete with those cultivated on mineral soils (Z. Solati et al., 2018), while providing additional ecosystem services.

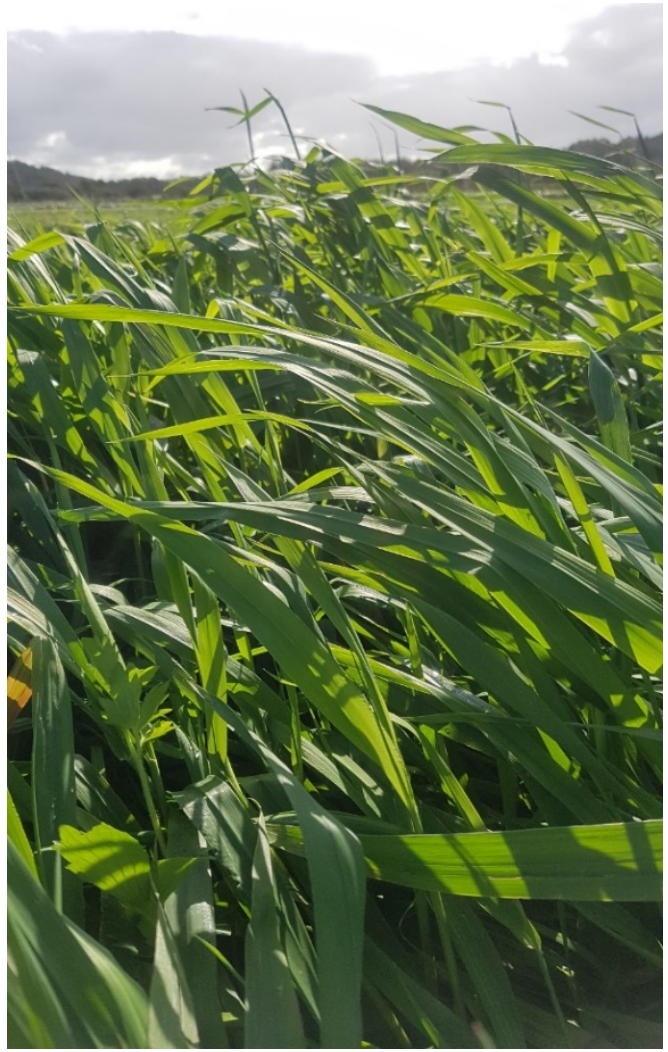

Fig. 6: Reed Canary Grass (RCG)

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