

# Estimating biorefinery output from forage crops via the Cornell Net Carbohydrate and Protein System

Thers H.<sup>1</sup>, Stødkilde L.<sup>2</sup>, Jensen, S.K.<sup>2</sup>, Eriksen J.<sup>1</sup>

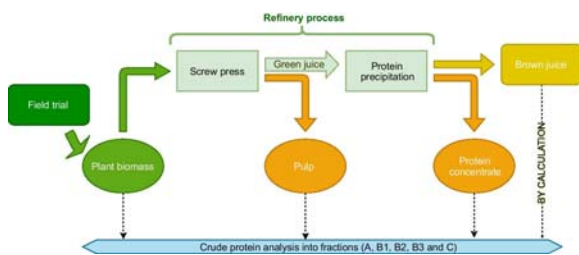
<sup>1</sup>Dept. of Agroecology, <sup>2</sup>Dept. of Animal Science, Aarhus University, Denmark

## Introduction

The protein concentrate output from grasses and forage legumes have promising properties for feeding monogastrics in terms of protein concentration and balanced amino acid composition. Here the CNCPS is used as a shortcut to estimate potential extractable protein concentrate in biorefinery output from forage crops.

## Materials and methods

- Five forage species processed in lab scale biorefinery. CNCPS protein fractions before and after refinery.
- Two years (1<sup>st</sup> and 2<sup>nd</sup> production year) estimation of full season refinery output

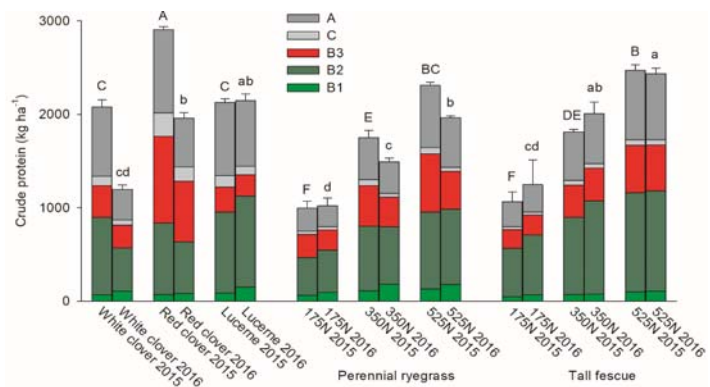


## Plant CP recovered in the protein concentrate.

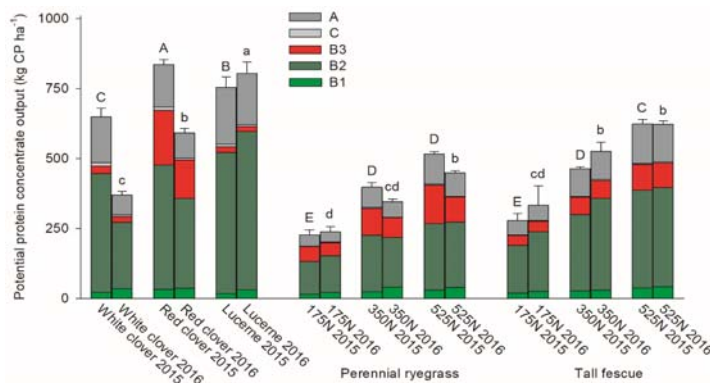
| Species       | A (%)      | B1 (%)    | B2 (%)    | B3 (%)   | C (%)      | Total (%) |
|---------------|------------|-----------|-----------|----------|------------|-----------|
| White clover  | 22 (4)AB   | 33 (1.4)A | 51 (5)A   | 8 (1.2)B | 12 (5)A    | 35 (3)A   |
| Red clover    | 17 (3)AB   | 45 (12)A  | 58 (6)A   | 21 (5)A  | 5 (2.1)B   | 35 (5)A   |
| Lucerne       | 26 (1.1)A  | 20 (4)A   | 58 (3)A   | 8 (1.3)B | 7 (0.7)AB  | 39 (1.9)A |
| Per. ryegrass | 16 (2.1)B  | 22 (9)A   | 29 (2.5)B | 22 (3)A  | 6 (1.9)AB  | 23 (2.0)B |
| Tall fescue   | 19 (1.5)AB | 38 (12) A | 33 (15) B | 18 (5) A | 6 (2.1) AB | 26 (5) B  |

## Total crude protein yield across four cuts in CNCPS fractions

- Plant crude protein yield showed that red clover had the highest CP yield in 1<sup>st</sup> year swards.
- Lucerne and the highest N fertilizer level of tall fescue gave the highest yield in 2<sup>nd</sup> year swards.



## Potential extraction of protein concentrate across four cuts



- Biorefinery extraction recovers in protein concentrates was included in the calculation.
- Red clover (1<sup>st</sup> year sward) and lucerne (2<sup>nd</sup> year sward) had the highest potential protein concentrate output.
- The legumes exceeded highly fertilized grasses in potential plant CP in protein concentrate.

## Conclusion

Accounting for potential recovery of plant CP into protein concentrate revealed that red clover and lucerne yielded the highest potential for protein concentrate. The non-N fertilized legumes thus exceeded highly fertilized grass species.



### References:

Thers H., Stødkilde L., Jensen S.K. & Eriksen J. (2021) Linking protein quality in biorefinery output to forage crop crude protein input via the Cornell Net Carbohydrate and Protein System. *Applied Biochemistry and Biotechnology*. 193: 2471-2482.  
 Thers H. & Eriksen J. (2022) Annual protein yield and extractable protein potentials in three legumes and two grasses. *Journal of The Science of Food and Agriculture*. 102: 3742-3751.