Optimizing grass production with dairy manure from precision animal feeding

Domingo-Olivé F. *and E. González-Llinàs*

IRTA Mas Badia – Sustainable Field Crops.

E-17141 La Tallada d'Empordà, Catalonia.

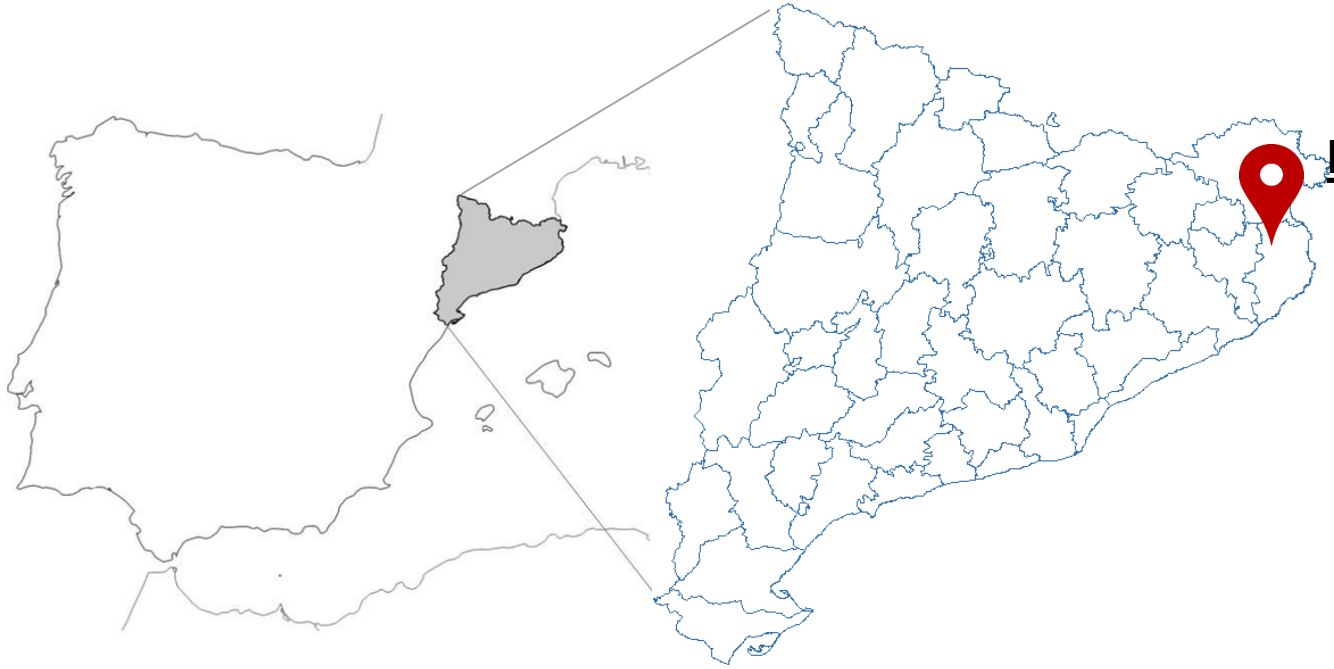
ISCRAES 2022

28-31 August 2022, Dublin, IRELAND

INTERNATIONAL SYMPOSIUM ON CLIMATE-RESILIENT AGRI-ENVIRONMENTAL SYSTEMS

Implementing the New Green Deal: The Path Towards Sustainable Agriculture

Catalonia: NE Iberian Peninsula



Empordà shire (Coastal Catalonia area)

Soil:

- Calcareous
- Moderately deep
- Sandy clay loam
- *Calcic Xerochrept (*USDA)

Climate:

- Mediterranean
- 650 mm annual average rainfall

Agricultural system:

- Intensive dairy production experimental farm
  - Conventional feeding
  - Precision feeding
  - Slurry from both systems
- Rainfed agriculture
- Winter fodder crops

Experimental design:

- Randomized blocks
- 8 fertilization treatments
- 3 replicates
- 30 m^2 elemental plot size (10x3)
- 1 crop trial: 2019-2020)
- Italian ryegrass crop (three cuts: January, April and May)

Treatment	Pre-sowing	After 1st cut	After 2nd cut
1	Ctrl	---	---
2	170 CS	---	80 Nmin
3		80 CS	---
4		80 CS	80 Nmin
5	170 PFS	---	80 Nmin
6		80 PFS	---
7		80 PFS	80 Nmin
8	100 Nmin	100 Nmin	100 Nmin

No fertilized (CTRL)
Conventional slurry (CS)
Precision feeding slurry (PFS)
N mineral fertilizer (Nmin)

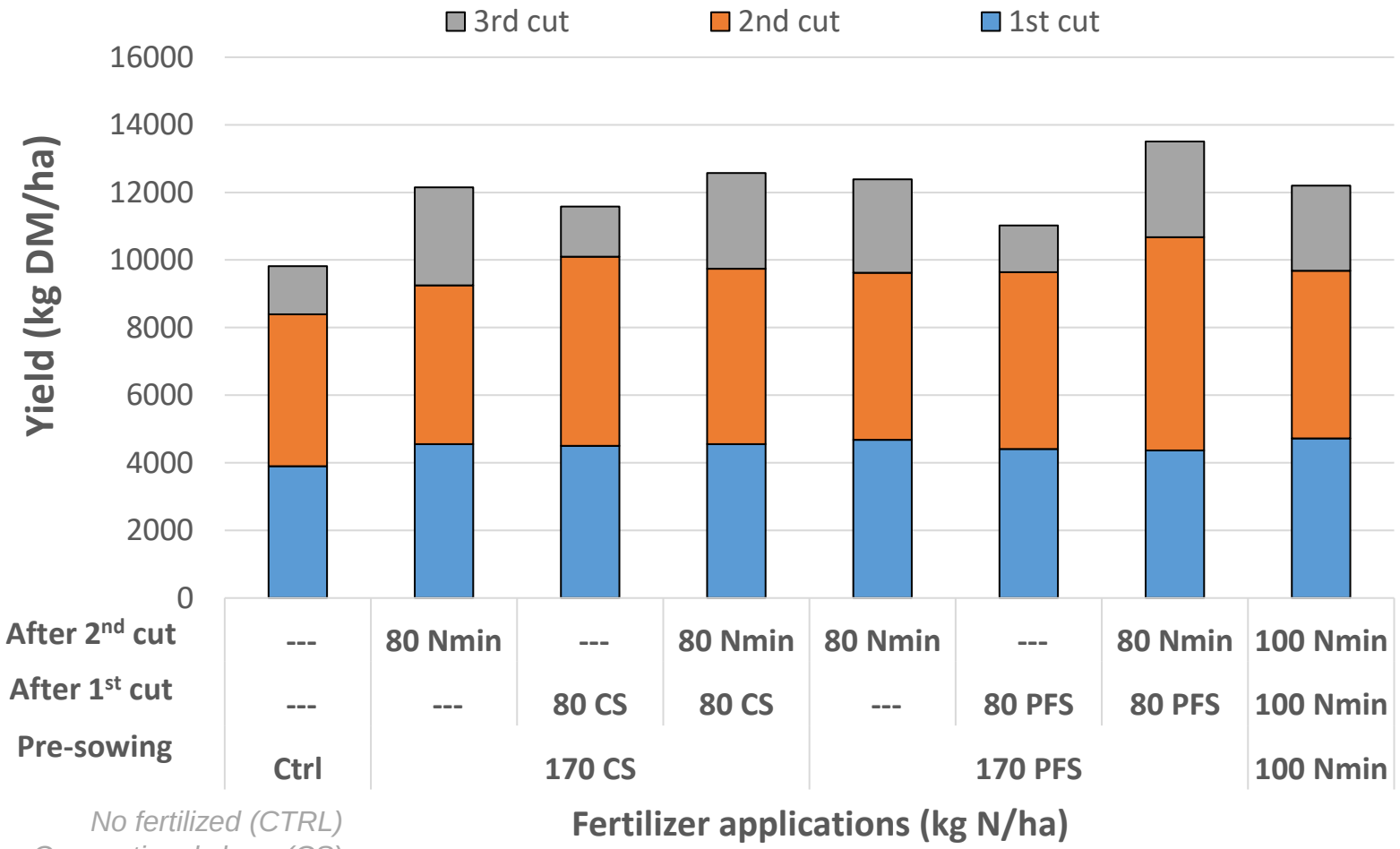
Pre-sowing application

Trial harvesting

Measured data:

- Yield (for each cut).
- Forage quality (for each cut).
- Initial and final soil analysis.
- Organic products characterization.

➢ Ryegrass Yield:



2265 kg DM ha^{-1}

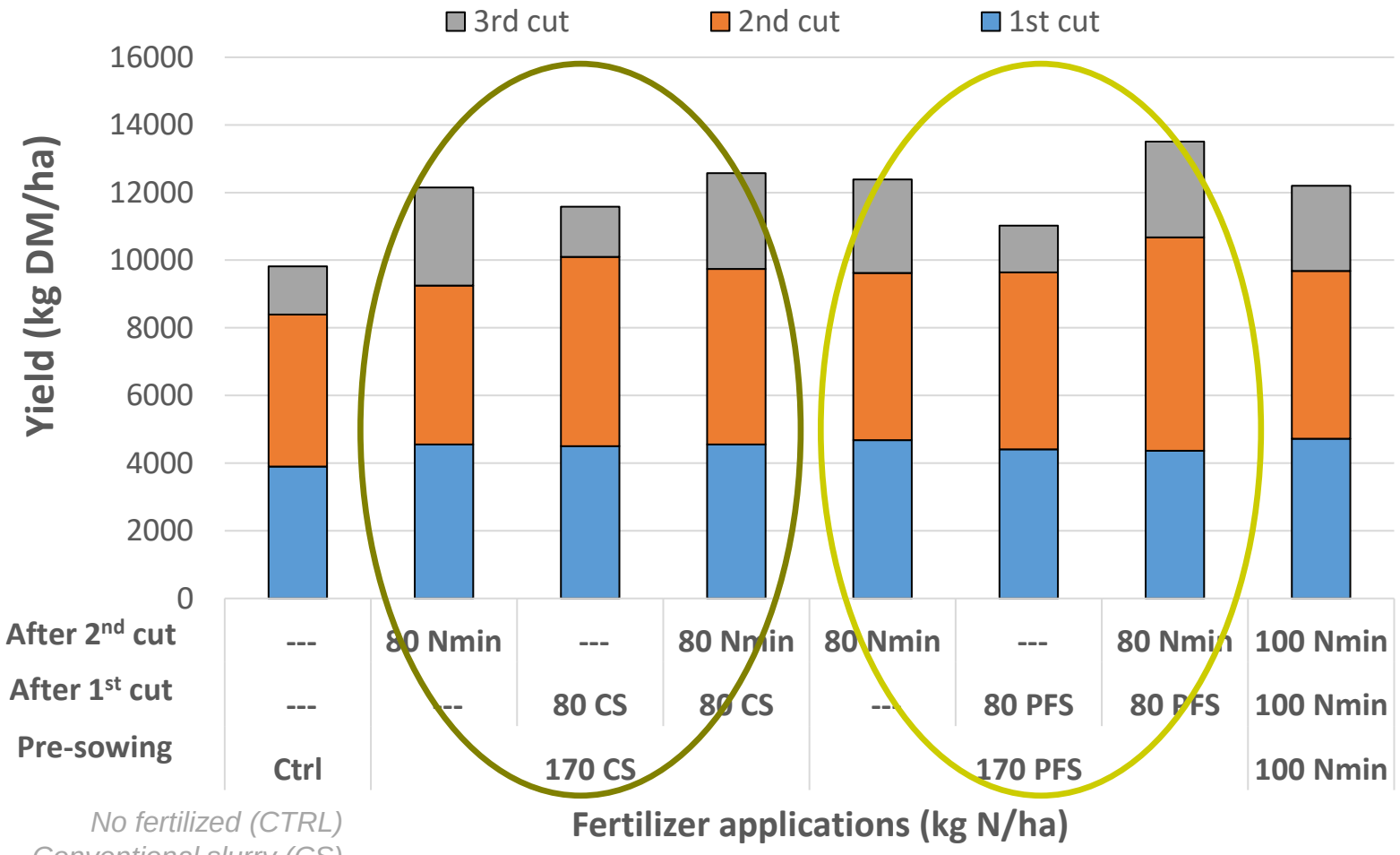
5180 kg DM ha^{-1}

4458 kg DM ha^{-1}

No fertilized (CTRL)
Conventional slurry (CS)
Precision feeding slurry (PFS)
N mineral fertilizer (Nmin)

The second cut is the most biomass yielding one

➢ Precision vs conventional feeding slurry:



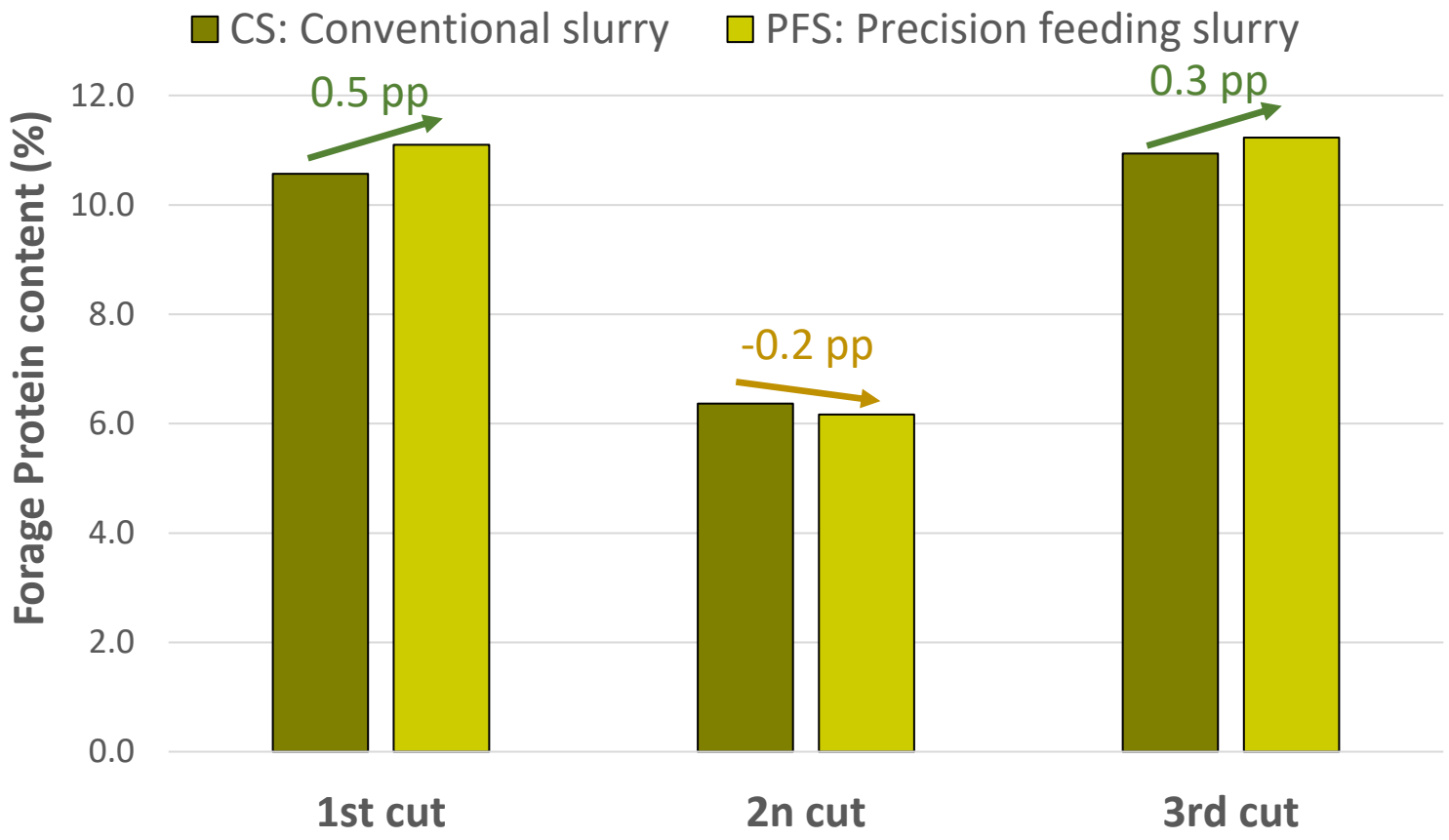
No fertilized (CTRL)
Conventional slurry (CS)
Precision feeding slurry (PFS)
N mineral fertilizer (Nmin)

Conventional feeding slurry: 12098 kg DM ha^{-1}

Precision feeding slurry: 12304 kg DM ha^{-1}

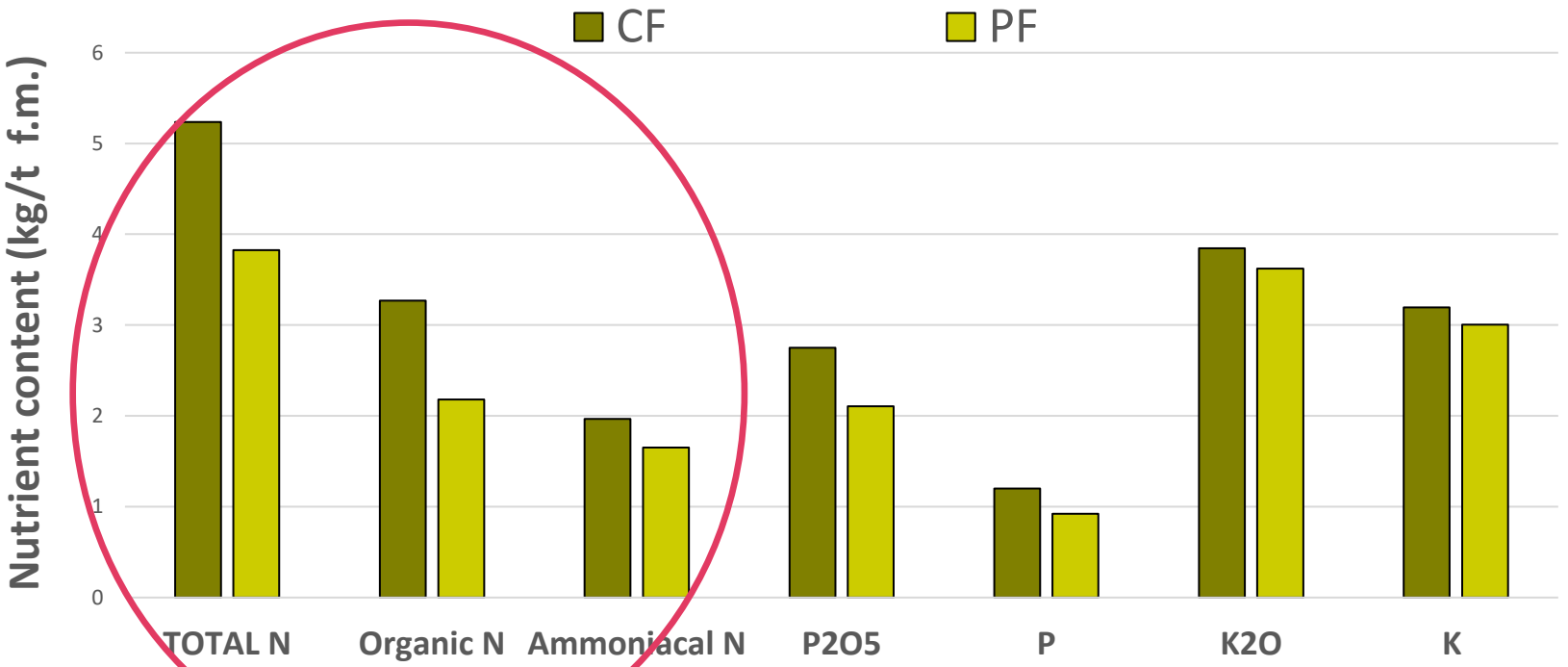
A slightly higher yield using precision feeding slurry, specially on the second cut.

➢ Precision vs conventional feeding slurry:



Ryegrass protein content tends to be higher when precision feeding slurry is used as fertilizer.
Specially remarkable in the first cut.

➢ Precision vs conventional feeding slurry:

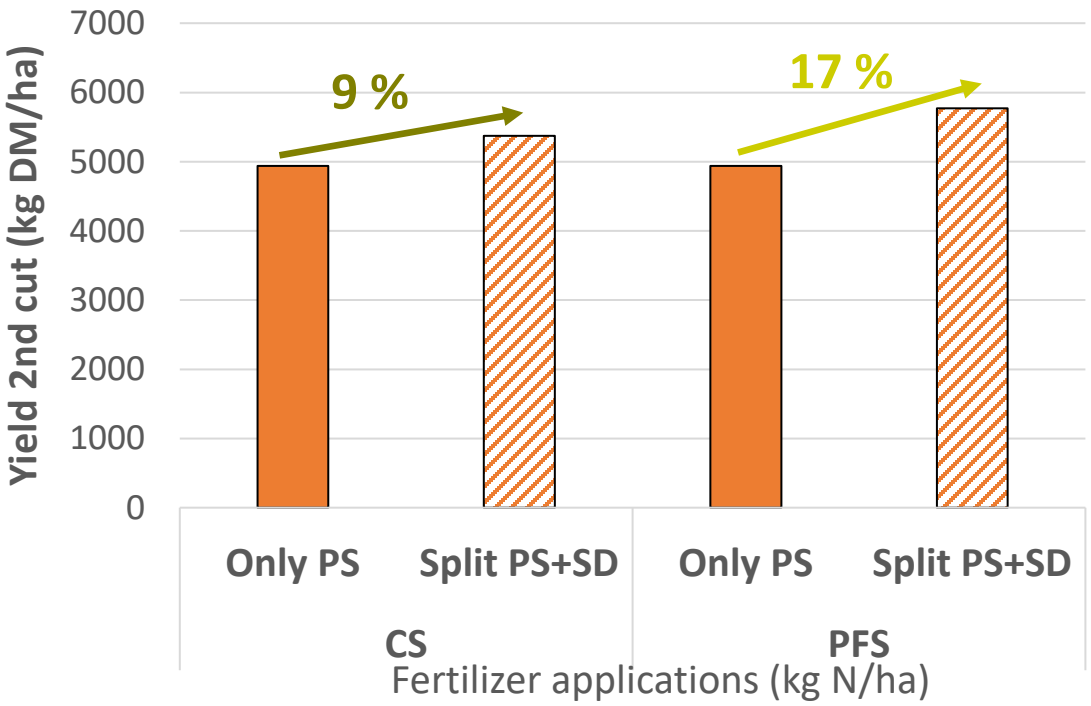


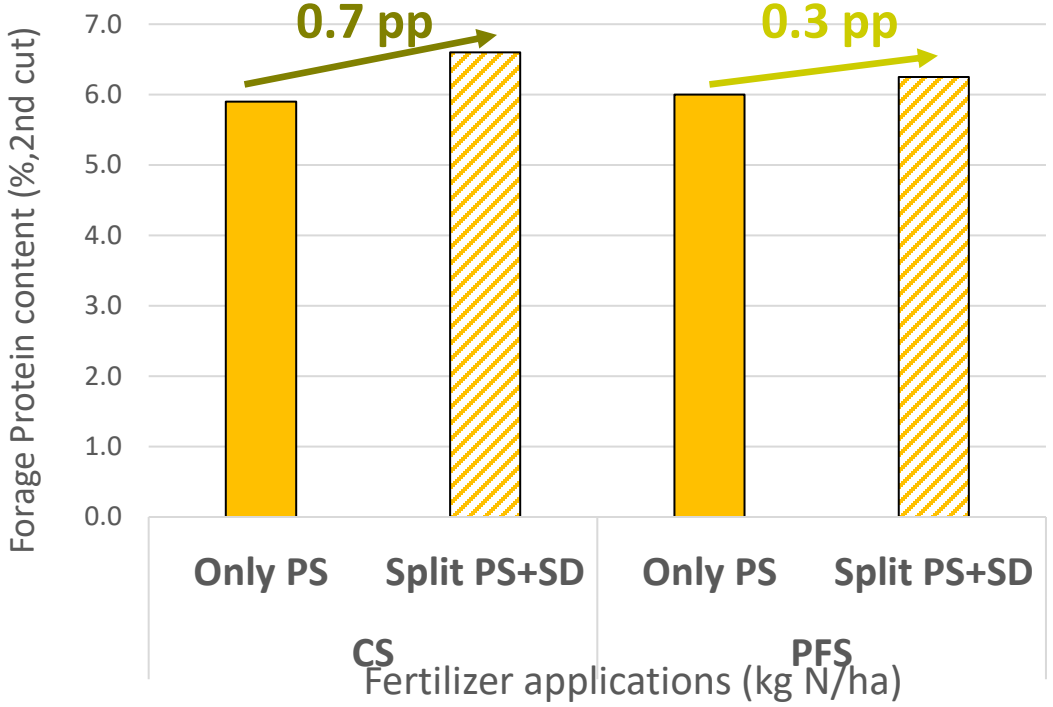
Precision feeding manure has a higher proportion of Ammonium-N (43 %) than the conventional feeding manure (38 %).

Ammonium-N is more available for crops than organic-N. Thus, applying precision feeding slurry makes N more available for a ryegrass crop, probably enhancing forage protein content.

➢ Application after ryegrass cuts:

PS: pre-sowing;
SD: side-dressing

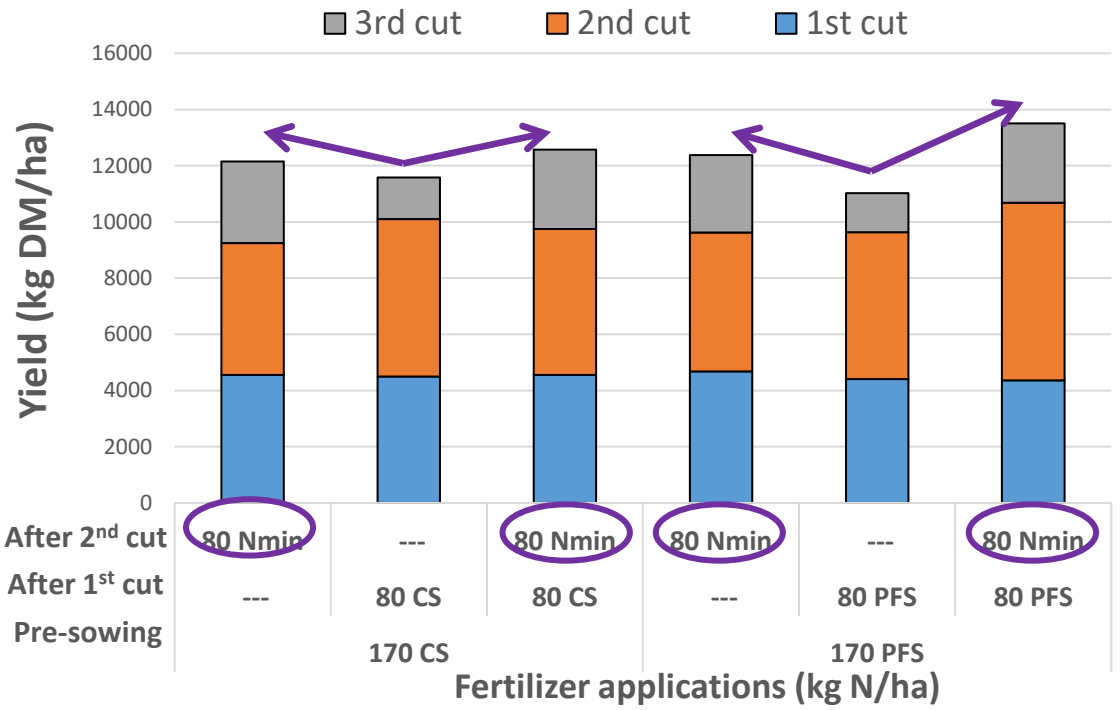


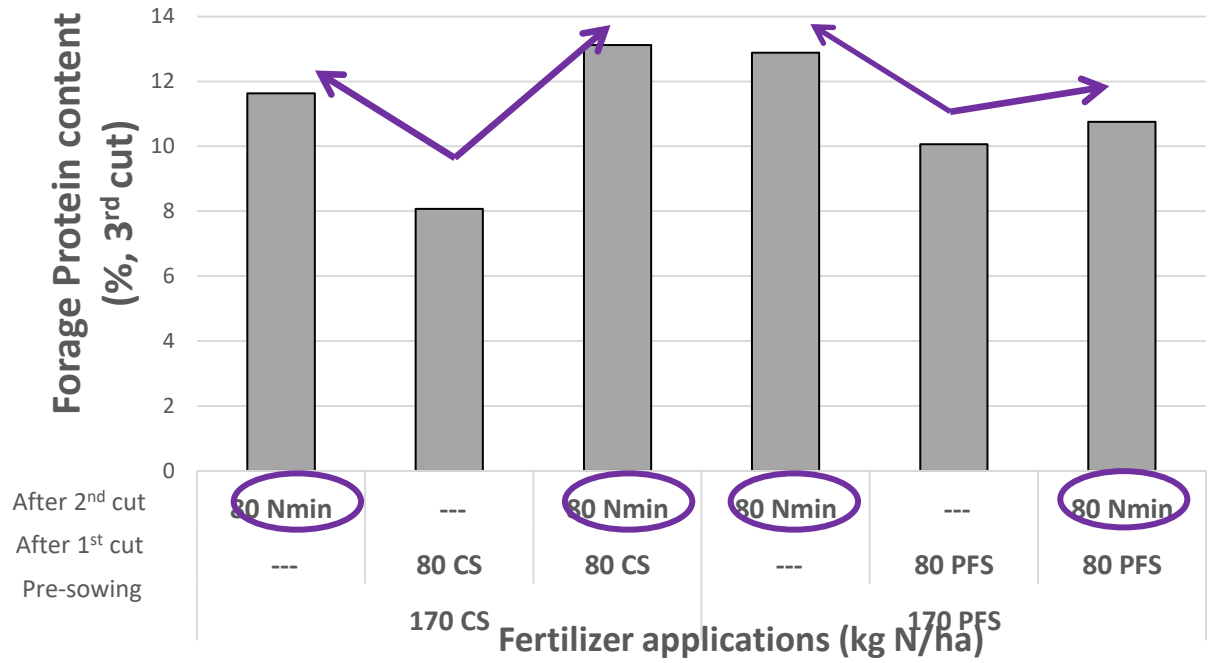


Applying slurry at pre-sowing (PS) and side-dressing (SD) increases DM yield in the second cut, in respect a single application at pre-sowing, for both types of slurry.
It also increases protein content.

➢ Application after ryegrass cuts:

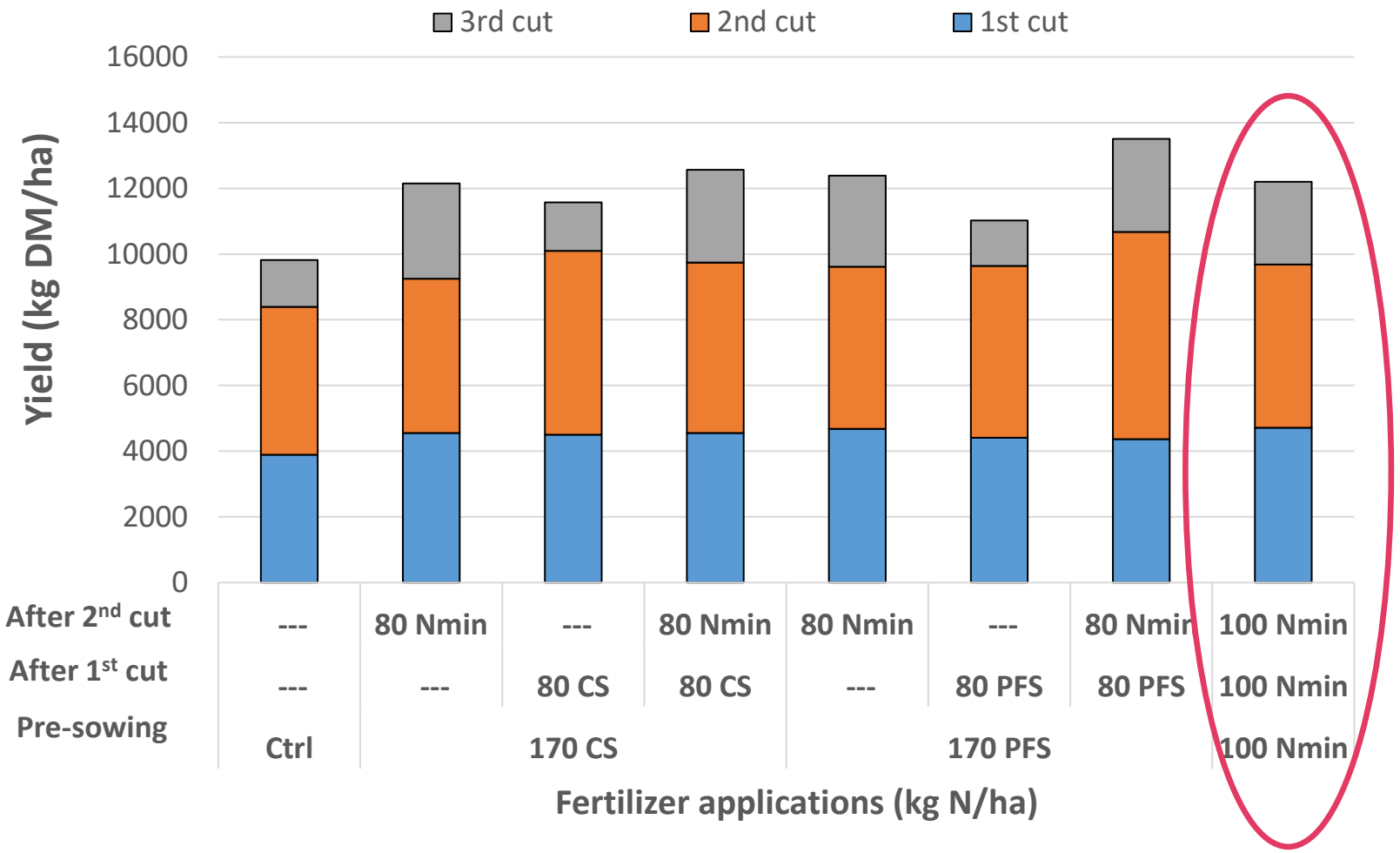
Conventional slurry (CS)
Precision feeding slurry (PFS)
N mineral fertilizer (Nmin)





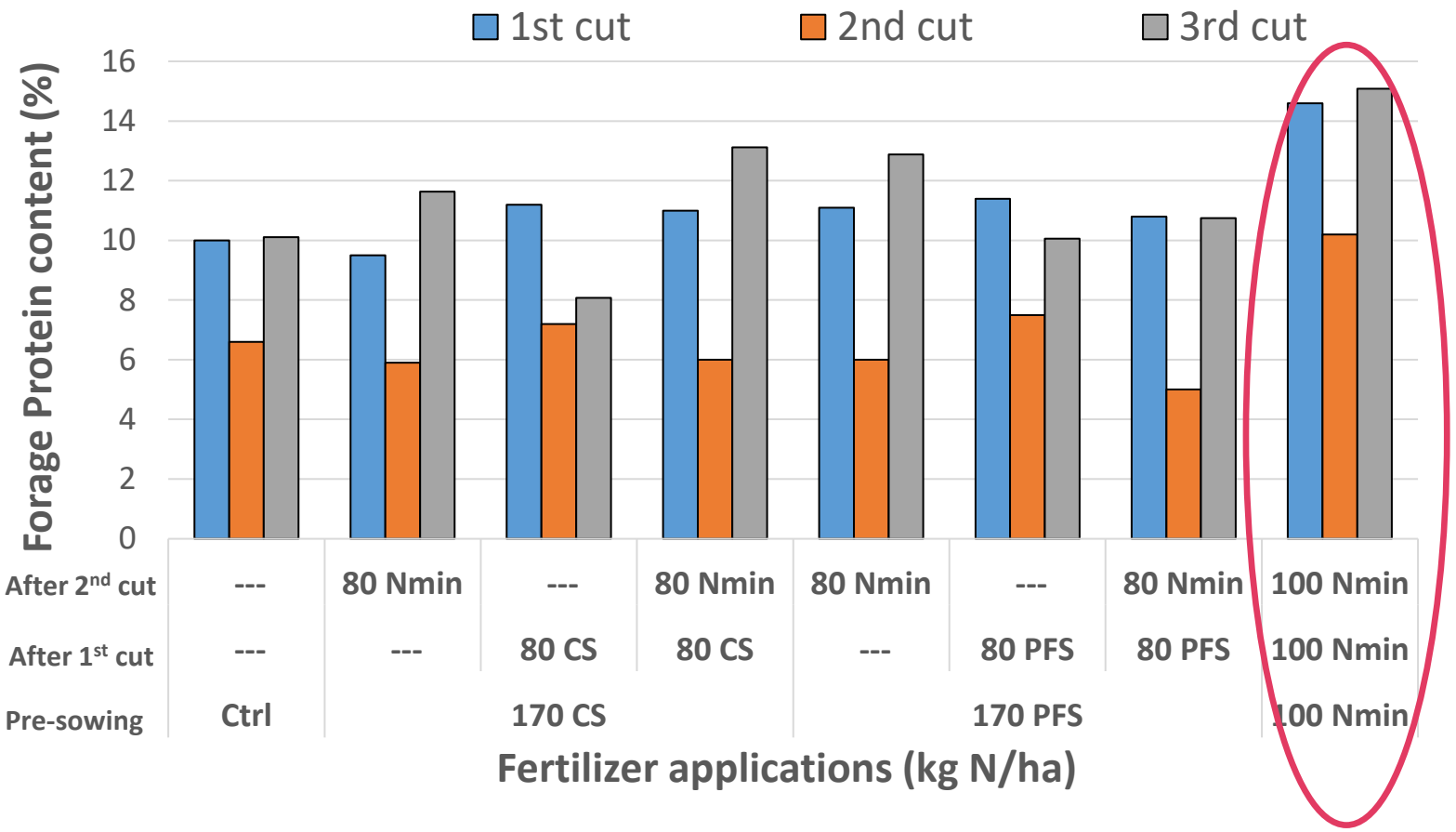
The application of N-mineral fertilizer after the second cut, increases crop yield (2767 kg DM ha^{-1} when applied, in respect to 1429 kg DM ha^{-1}). It also increases crop protein content (3 pp in average), specially for the conventional feeding slurry (4.3 pp).

➢ Slurry vs Mineral fertilization



The use of slurry as fertilizer for ryegrass has achieved similar yield (12201 kg DM ha^{-1} on average) than the use of mineral N fertilizer (12187 kg DM ha^{-1}), at similar N-rate application.

➢ Slurry vs Mineral fertilization



The use of mineral N fertilizer increases in 3.9 pp the crop protein content in respect to the use of slurry as fertilizer for ryegrass, at similar N-rate application.

➢ Main ideas for ryegrass fertilization optimization:

- Using slurry from precision feeding significantly increases protein content in the plant, but not yield on a general basis. It is probably due to its higher content in Ammonium-N in respect to conventional feeding slurry.
- Applying slurry at pre-sowing and side-dressing increases DM yield in respect a single application at pre-sowing, and it also increases protein content.
- The application of N-mineral fertilizer after the second cut, increases crop yield and crop protein content.
- N mineral fertilization clearly increases crop protein content, but not DM yield in respect to slurry application.

➢ A combined use of precision feeding slurry and mineral N fertilizer may lead to maximum achievable yields and good enough forage protein content.

➢ The application of slurry at pre-sowing and after the first cut, at agronomic rates, increases crop performance in respect to single applications at pre-sowing.

Part of the information presented has been obtained from work carried out in the framework of :

- *Plans per la millora de la fertilització agrària a les Comarques Gironines, el Vallès i Osona. Financed by the Department of Agriculture of the Government of Catalonia.*
- *CIRCULAR AGONOMIC project (Grant Agreement No 773649) - "Eficient Carbon. Nitrogen and Phosphorus cycling in the European Agri-food System and related up- and down-stream processes to mitigate emissions'".*

Mas Badia
Cultius Extensius Sostenibles

Oficina de fertilització i tractament de dejeccions ramaderes

"WE SHARE OUR SCIENCE TO FEED THE FUTURE"

THANK YOU FOR YOUR ATTENTION

Circular Agronomics

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme. under Grant Agreement No 773649

Optimizing grass production with dairy manure from precision animal feeding

Domingo-Olivé F. *and E. González-Llinàs*

IRTA Mas Badia – Sustainable Field Crops.

E-17141 La Tallada d'Empordà, Catalonia.

ISCRAES 2022

28-31 August 2022, Dublin, IRELAND

INTERNATIONAL SYMPOSIUM ON CLIMATE-RESILIENT AGRI-ENVIRONMENTAL SYSTEMS

Implementing the New Green Deal: The Path Towards Sustainable Agriculture