A new methodology to estimate protein feed value using the milk protein biological response

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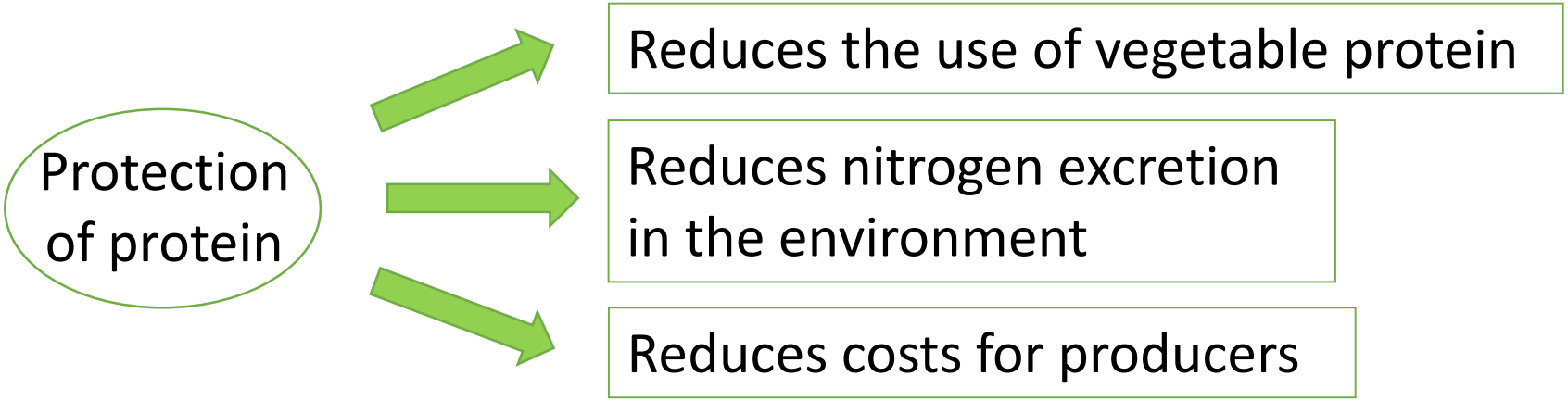
Introduction



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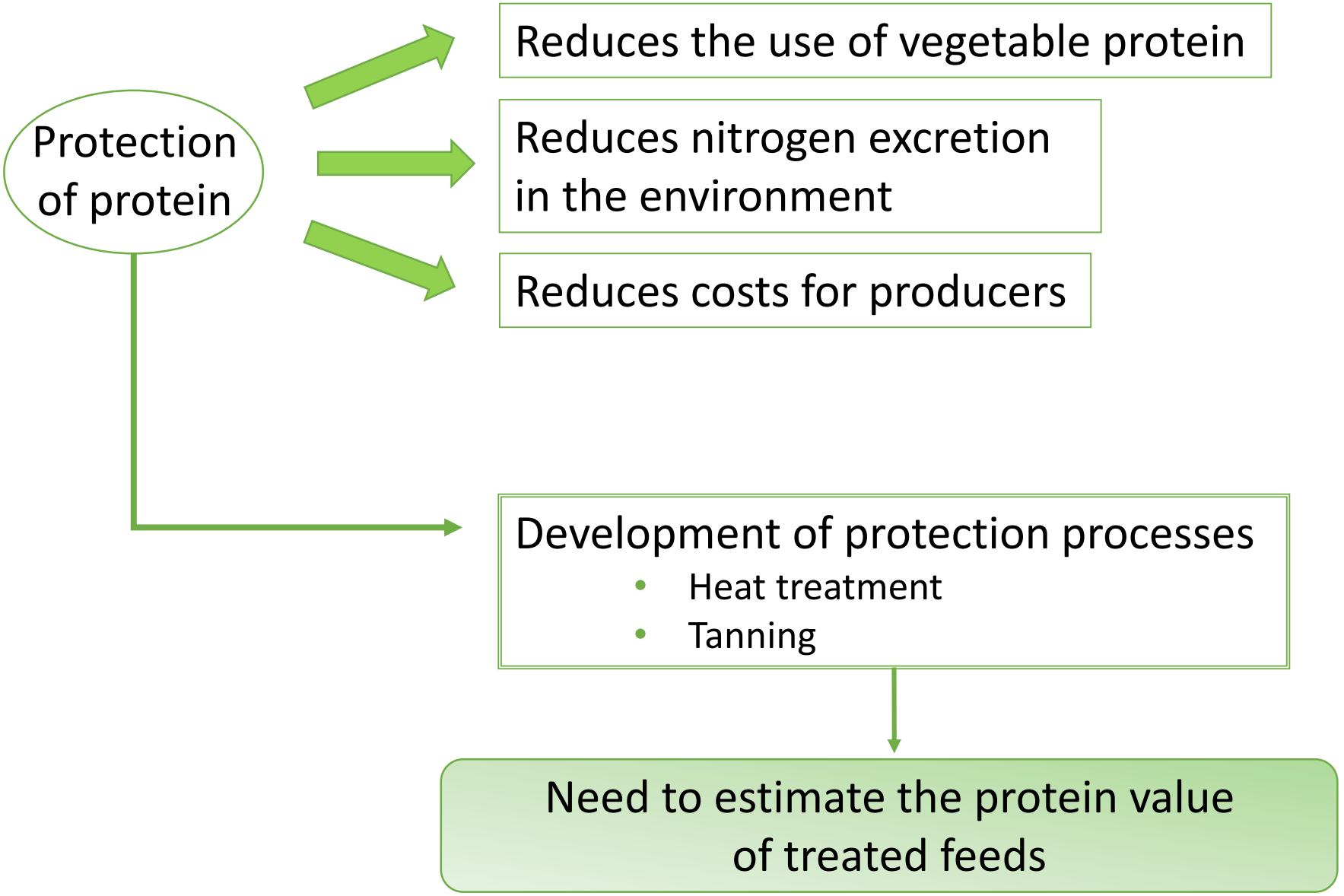

Introduction

- Methods used to estimate protein value of protected feeds
  - *In vivo*: measurement of nitrogen duodenal flow
    - Fistulated cows
    - Low accuracy, expensive and time-consuming
  - *In vitro*: test of degradability with ruminal extracted or commercial enzymes
    - Large number of samples tested
    - Bias links to selection of enzymes
  - *In sacco*: test of degradability of feeds by incubation in rumen
    - Most commonly used
    - Particulate losses and microbial colonization in bags

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  - *In sacco*: test of degradability of feeds by incubation in rumen
    - Most commonly used
    - Particulate losses and microbial colonization in bags
- Development of new techniques to protect protein from ruminal fermentations (essential oils, vegetable tannins)
  - Have systemic effects in the rumen
  - Can not be estimated with classical methods

Introduction

- Need for a new and more systemic method
  to estimate feeds protein value
- Hypothesis: biological response can be used as new method
  - Overall response of animal to protein intake
  - Comparison of different technics of protein protection

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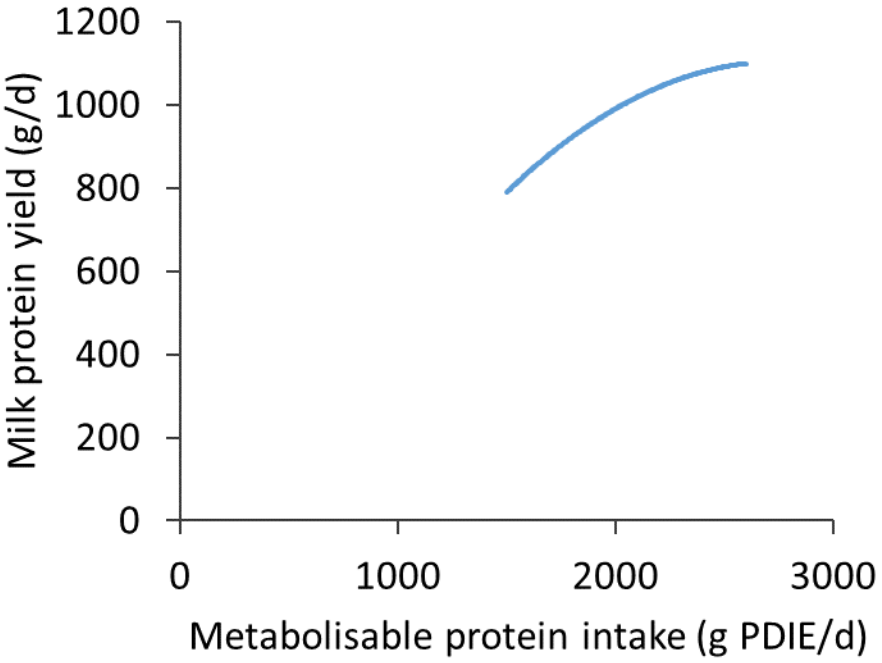
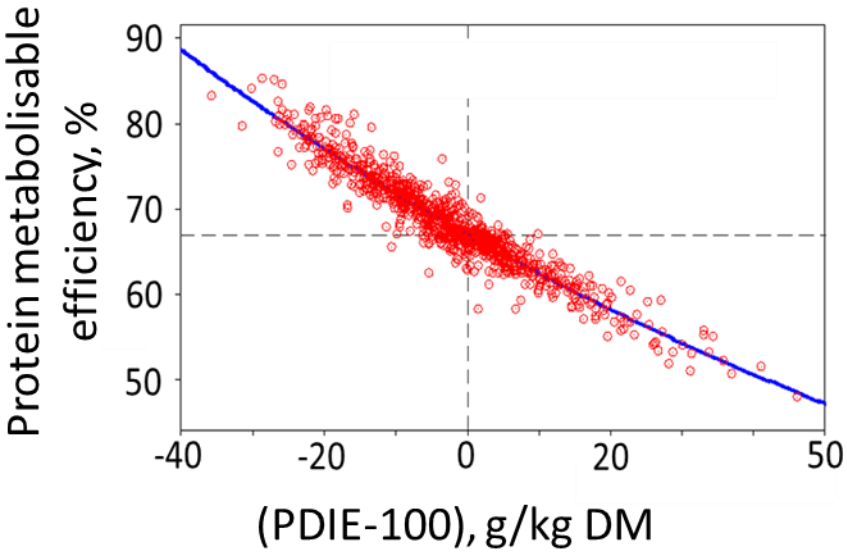
Can milk protein yield response can be used as a new method to estimate feeds protein value?

- ➢ Protein value of an unknown feed can be determined from its milk protein yield response
- ➢ Use of two known dietary controls (positive and negative)

Principle of the method





(Sauvant et al. 2015)

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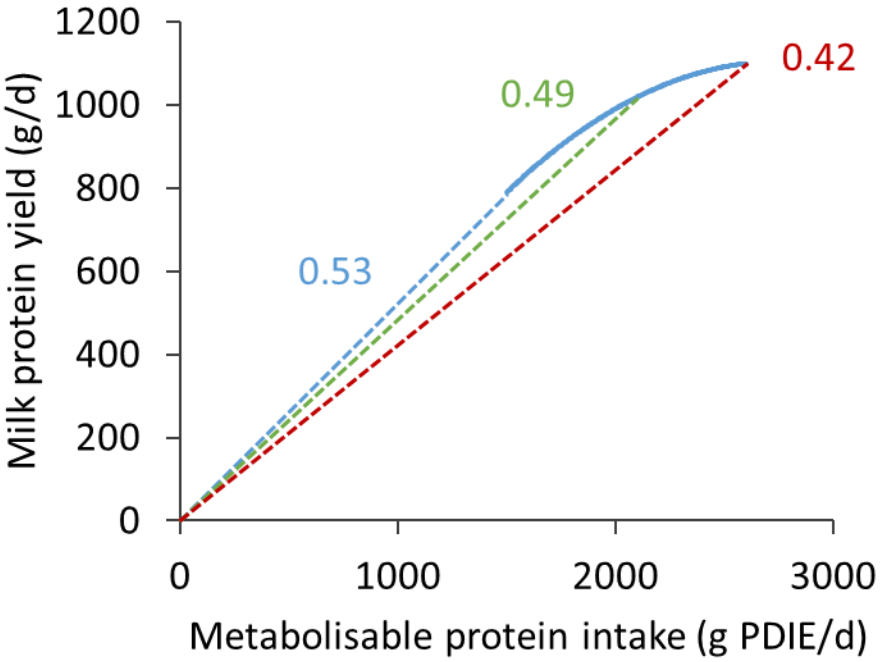

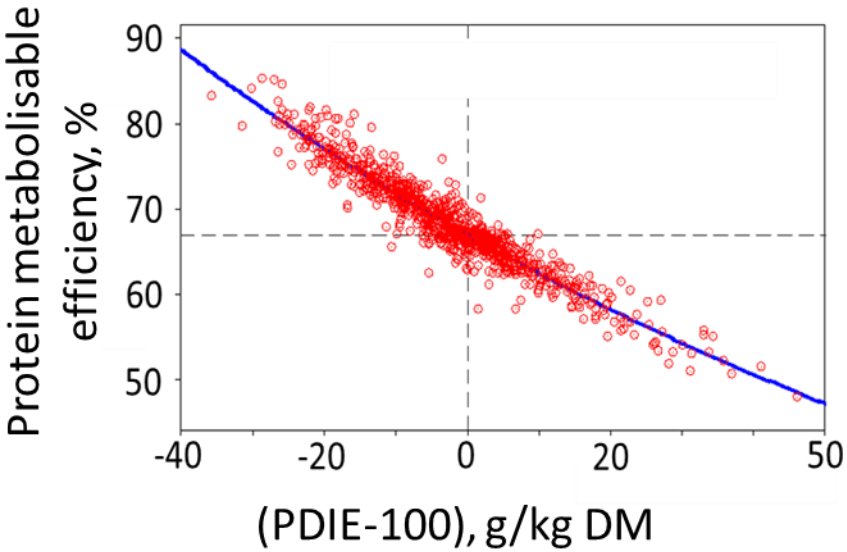

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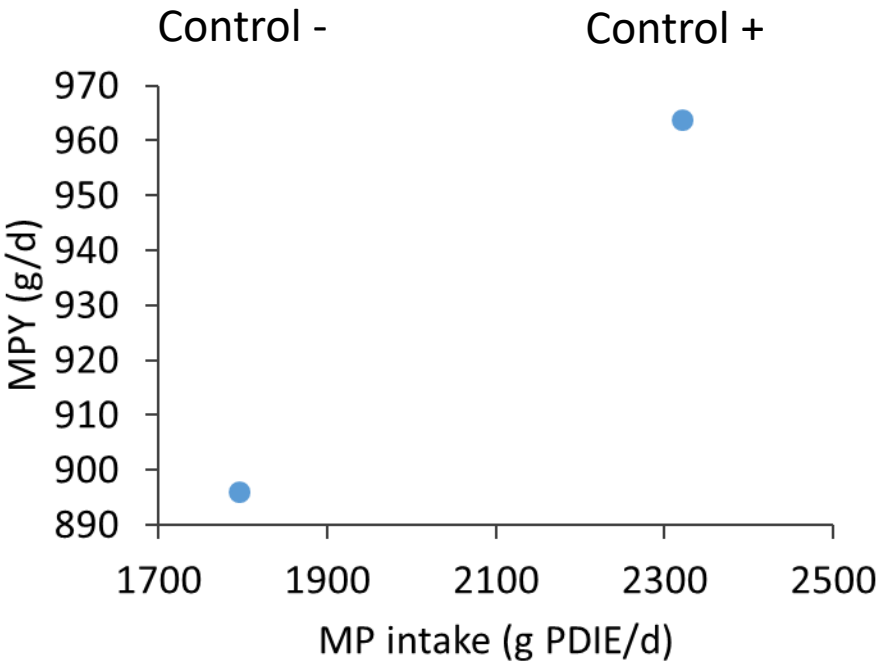

MP = metabolisable proteins; MPY = milk protein yield

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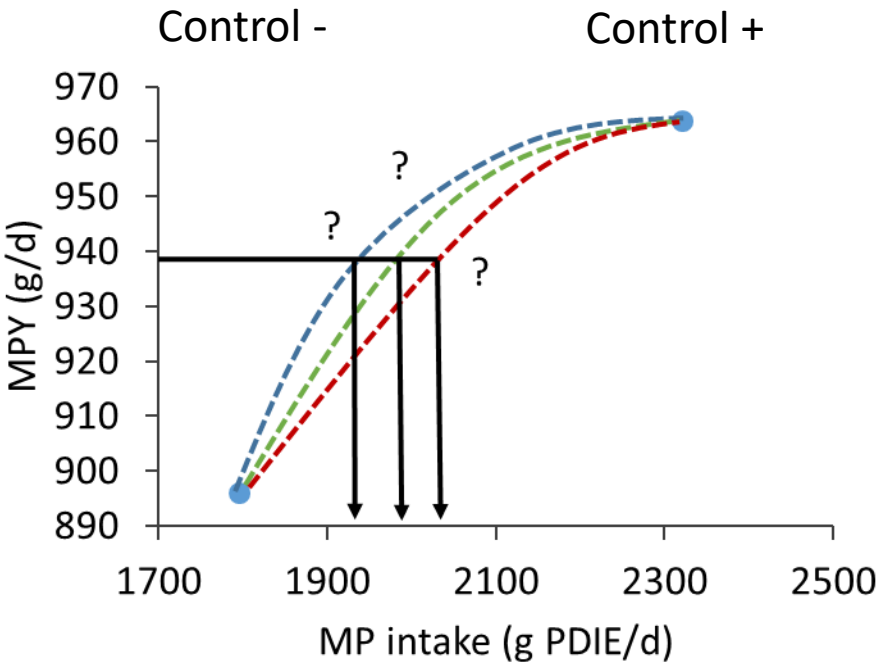

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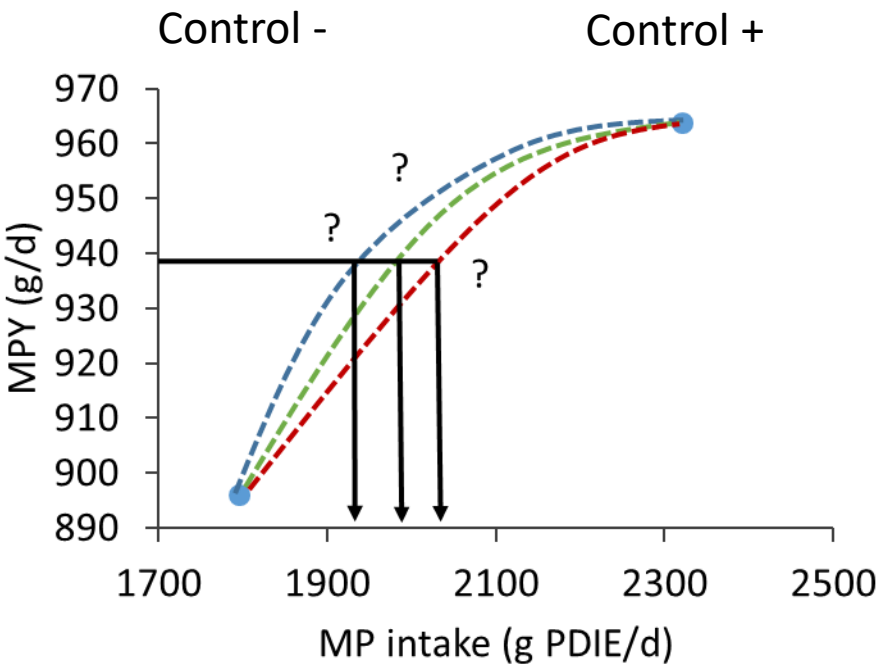

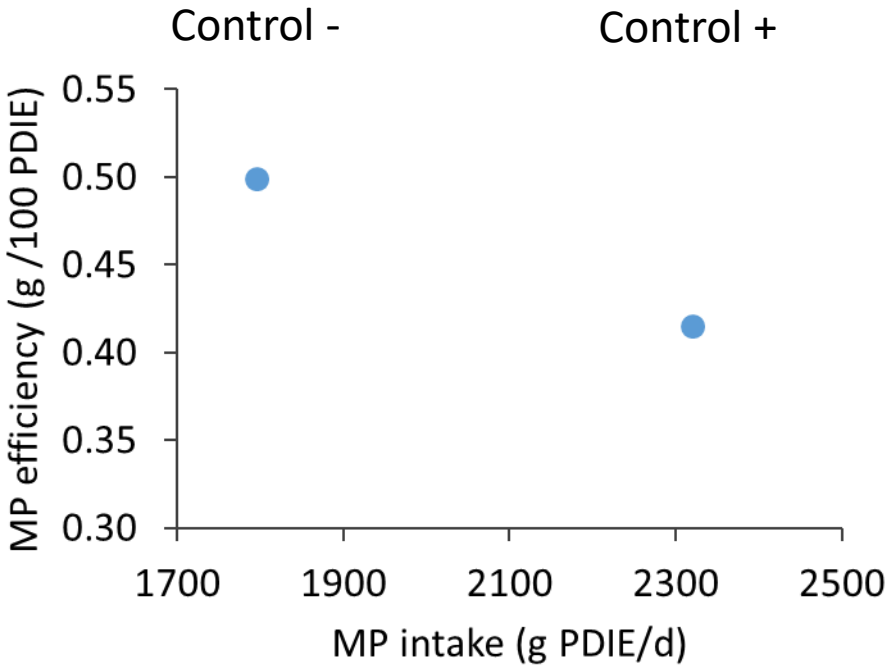

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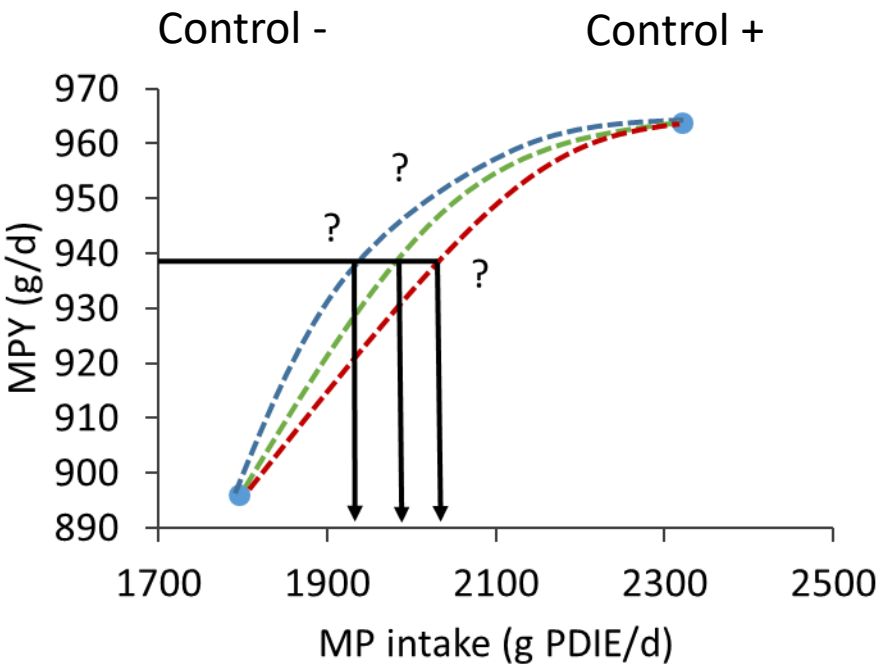

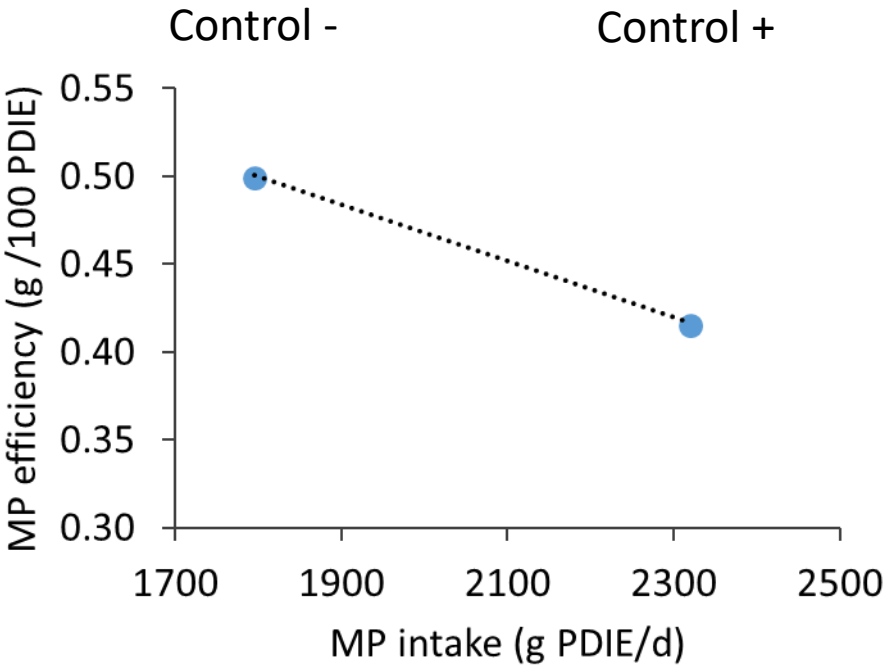

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- Assumption of linearity

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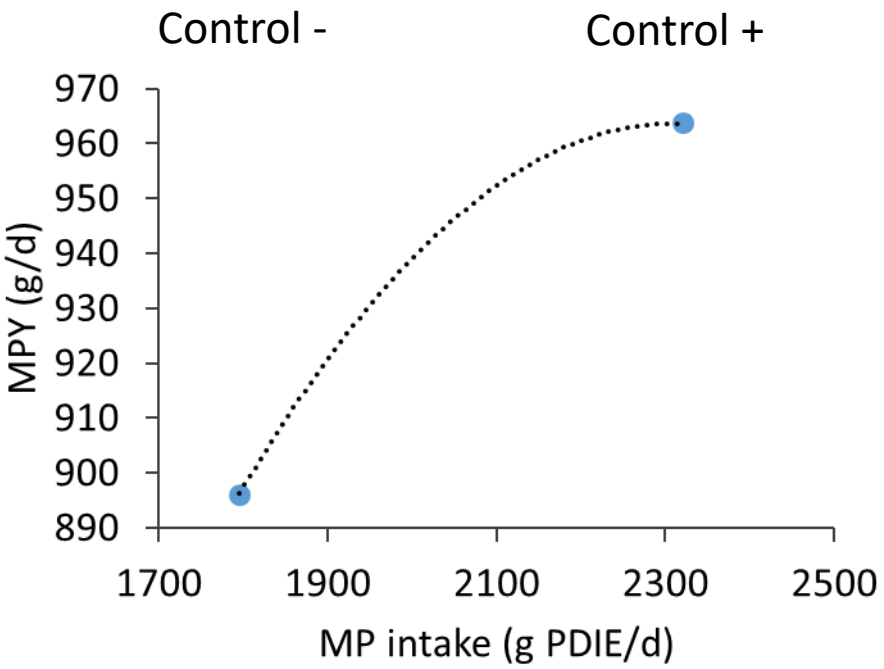

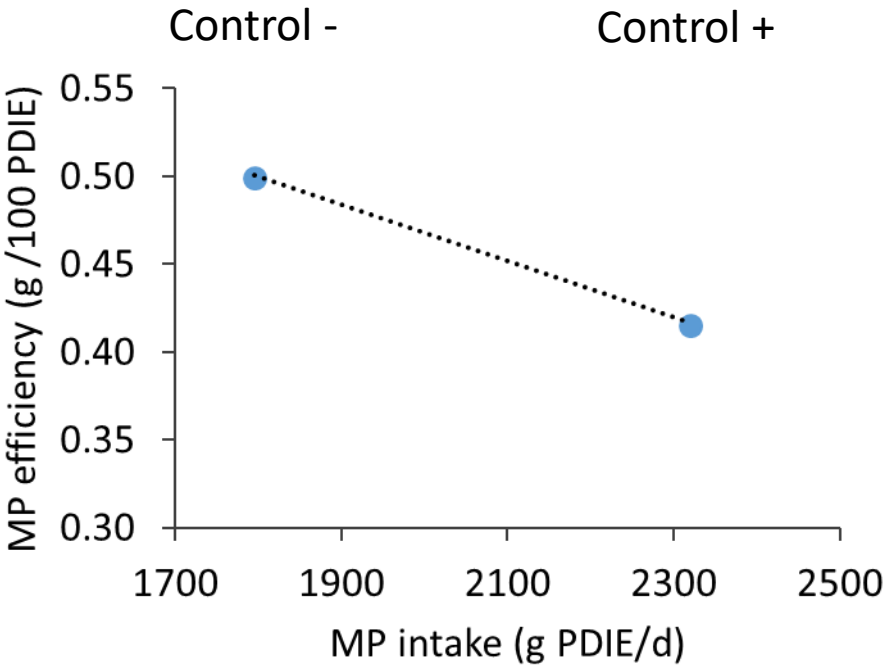

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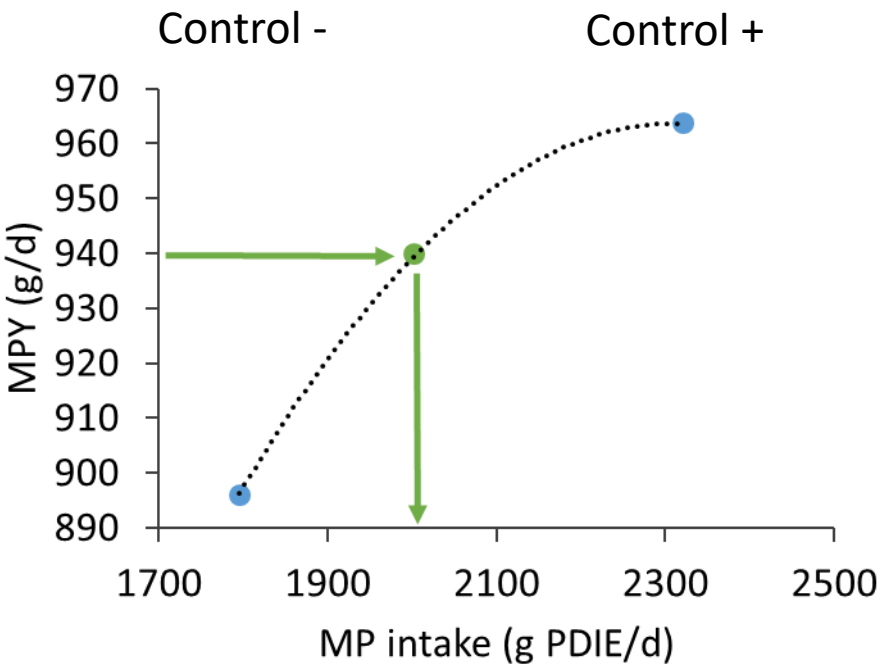

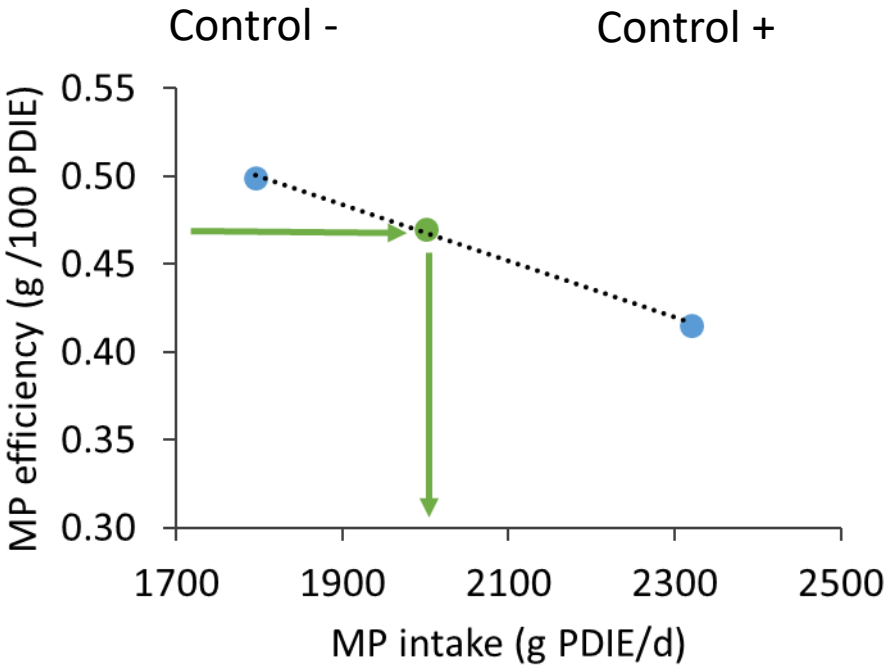

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Diets

- Same basal ration: 78% maize silage, 9.5% dehydrated lucerne, 7.5% soya bean meal, 5% energetic concentrate + mineral
- 4 dietary treatments : 2 known controls + 2 medium treatments

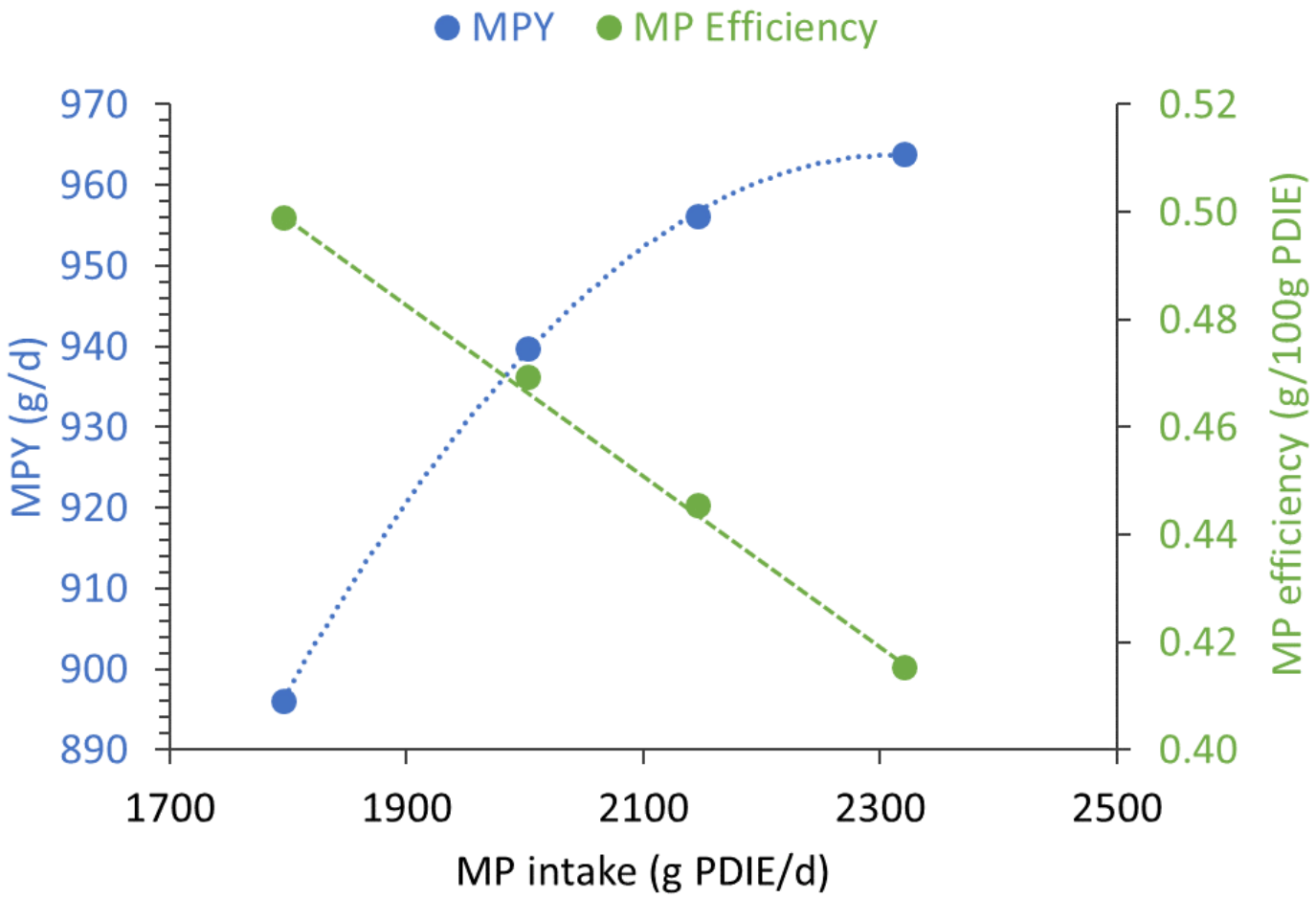
Dietary treatments	Soya bean meal (kg)	Energetic concentrate (kg)	Urea (kg)	MP (g PDIE/kg DM)
Control -	0	3.4	0.27	97
Medium Low	1.2	2.3	0.17	151
Medium high	2.2	1.0	0.09	204
Control +	3.3	0	0	252

- Avoid variations in MPY responses:
  - Energy: limited quantities
  - Microbial synthesis: same and not limiting degradable N supplies (urea)

Experimental design

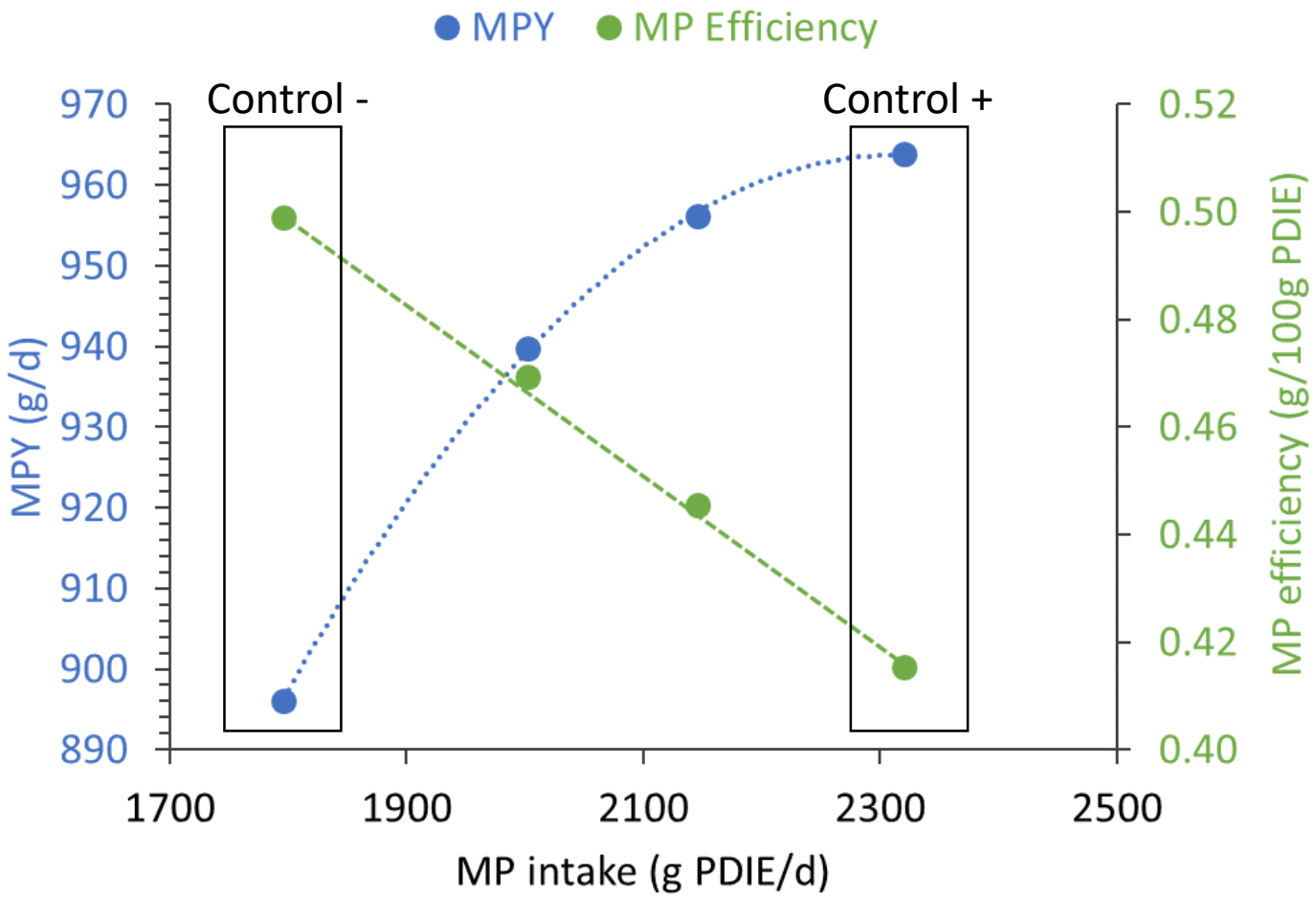
- 24 cows in 6 blocks of 4 homogenous cows
  - Repartition based on production level and parity
- 4 dietary treatments: Latin square design in each block
- 4 periods of 3 weeks
- Measurements: milk production + composition

MPY and MP efficiency response



- MPY response: 67 g/d
- MP efficiency: slightly curved

MPY and MP efficiency response



- Estimate protein value of the 2 medium treatments from their MPY response
- Comparison to theoretical values (INRA 2007)

Estimation of protein value

Dietary treatments	Theoretical value (g PDIE/kg DM)	Estimated value (g PDIE/kg DM)	Difference
Medium Low	151	165	+14
Medium High	204	221	+17

- Positive bias in the estimation

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Medium Low	151	165	+14
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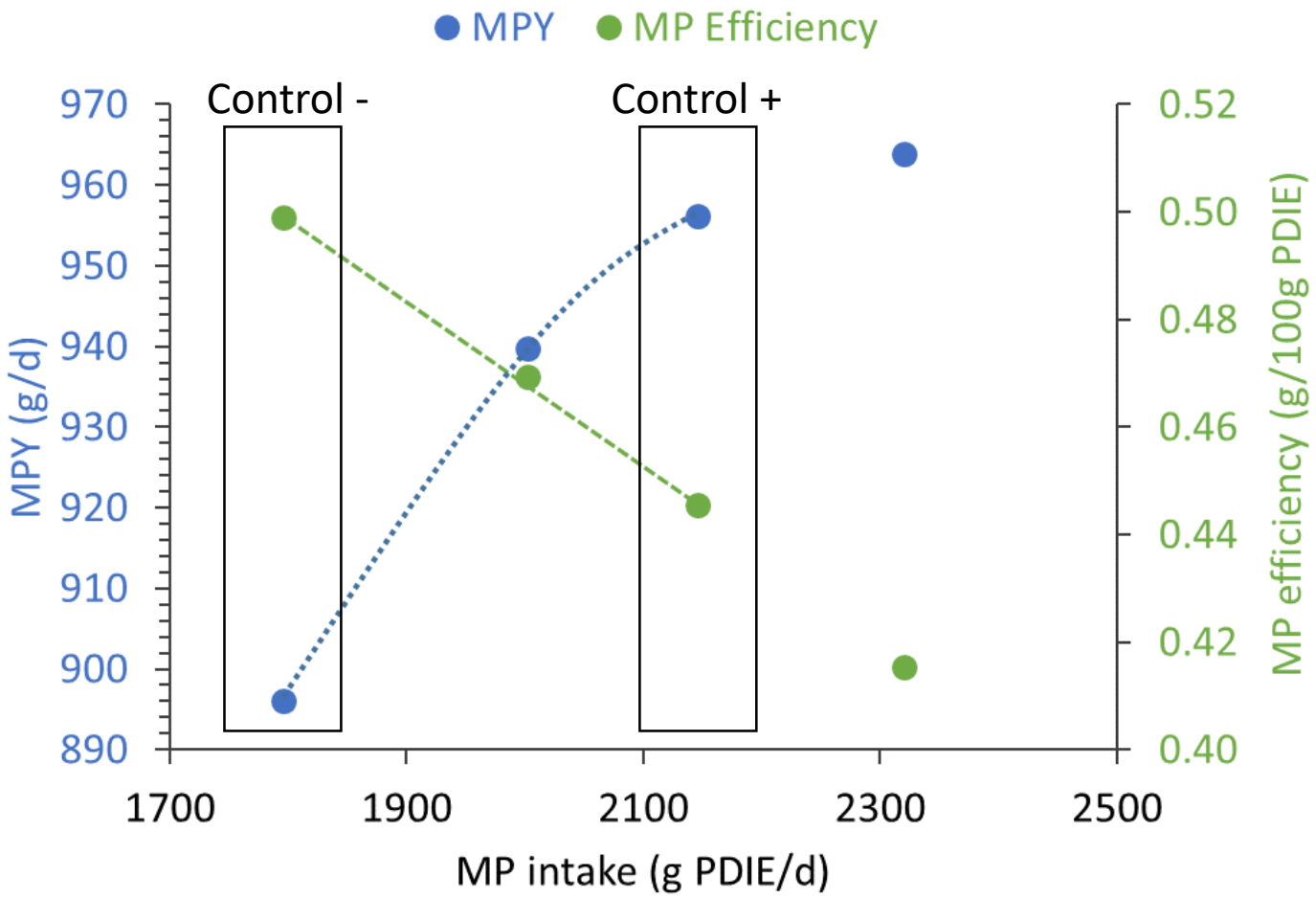
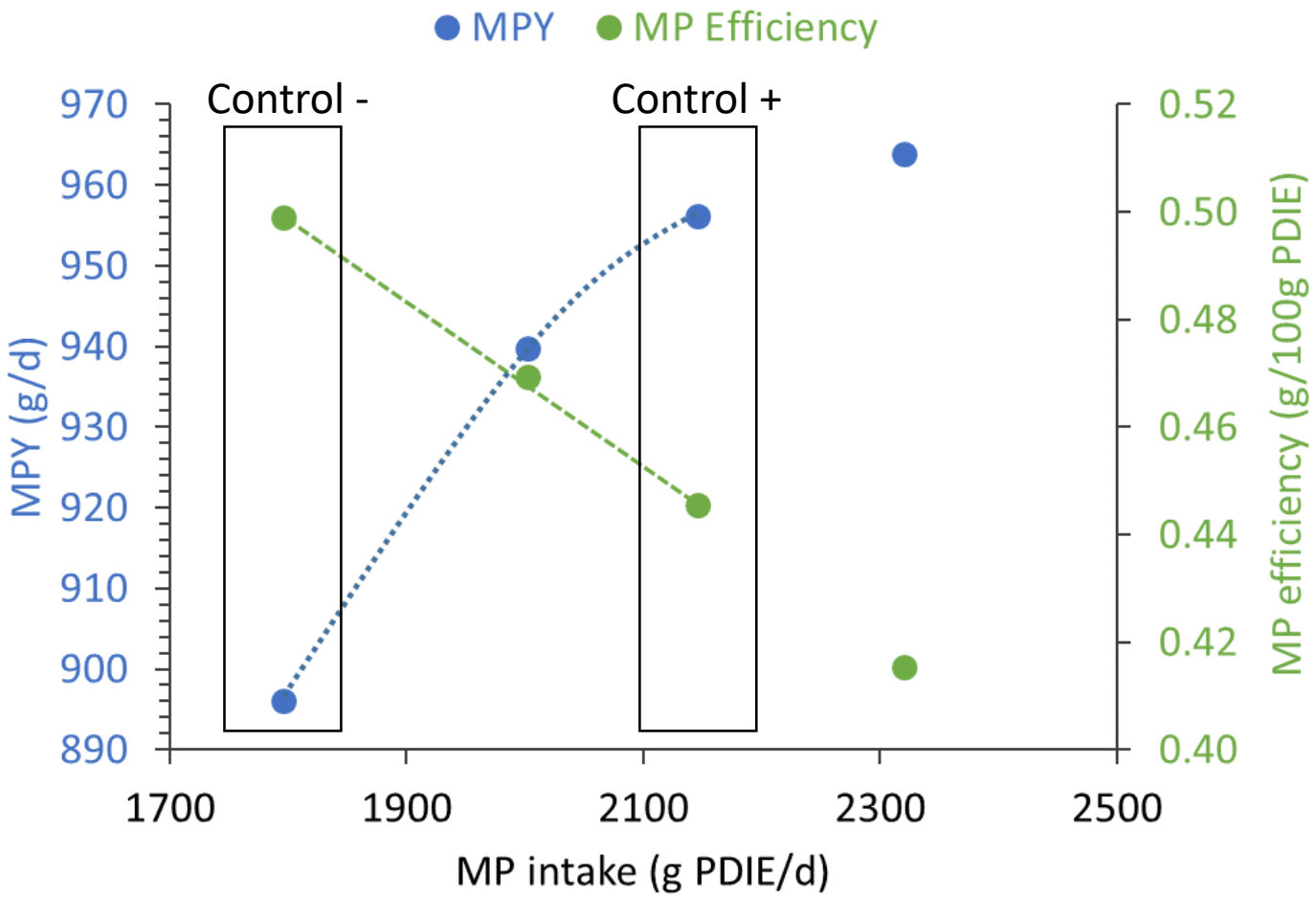
- Positive bias in the estimation
- Influence of Control + ?
  - In the upper part of MPY response = slow MPY response to protein supplies

Influence of control +



- Reduce the value of control +
- More important response in MPY

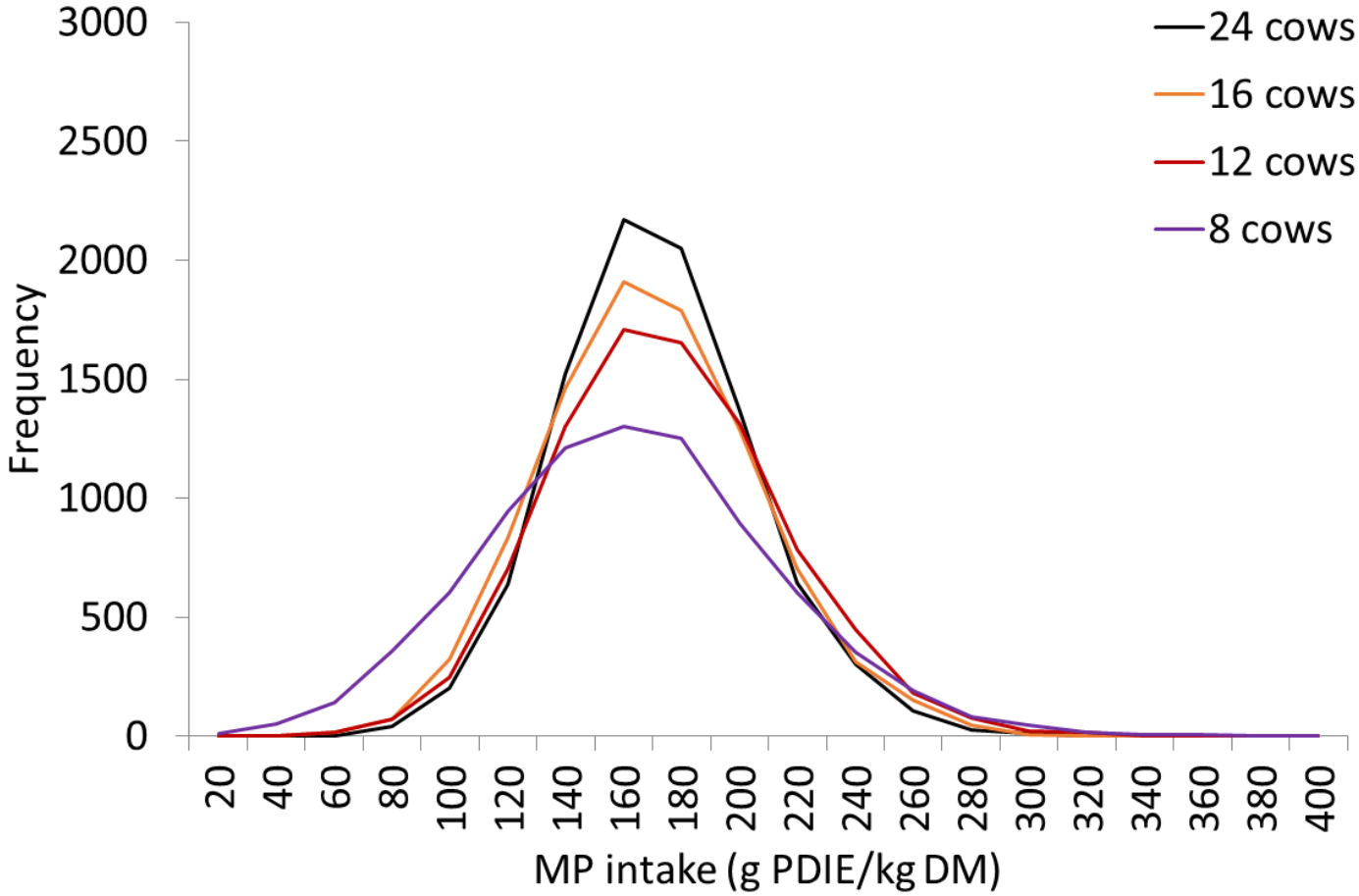
Influence of control +



Dietary treatments	Theoretical value (g PDIE/kg DM)	Estimated value (g PDIE/kg DM)	Difference
Medium Low	151	158	+7

Influence of the number of cows

- Uncertainty analysis on the Medium Low dietary treatment



- Under a number of 12 cows
  - Higher variability of estimates
  - Increase risk of bias

Conclusion

- MPY response seems to be a relevant approach to estimate feeds protein value

- Easy method, applicable in facilities equipped with feeds dispensers with no experimental measurements

- Estimation of all kind of protein protection
  - Based on physical link with feeds: heat treatment
  - Targeted microbial activity: essential oils, vegetable tannins

- Special attention in diets formulation
  - Avoid variations in MPY response (energy and microbial synthesis)
  - Avoid the range where MPY response is low (rich-protein supply)