A starch binding agent decreases the rate of fermentation of wheat in a dose-dependent manner

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Background

- There is variation in starch content between and within grains.

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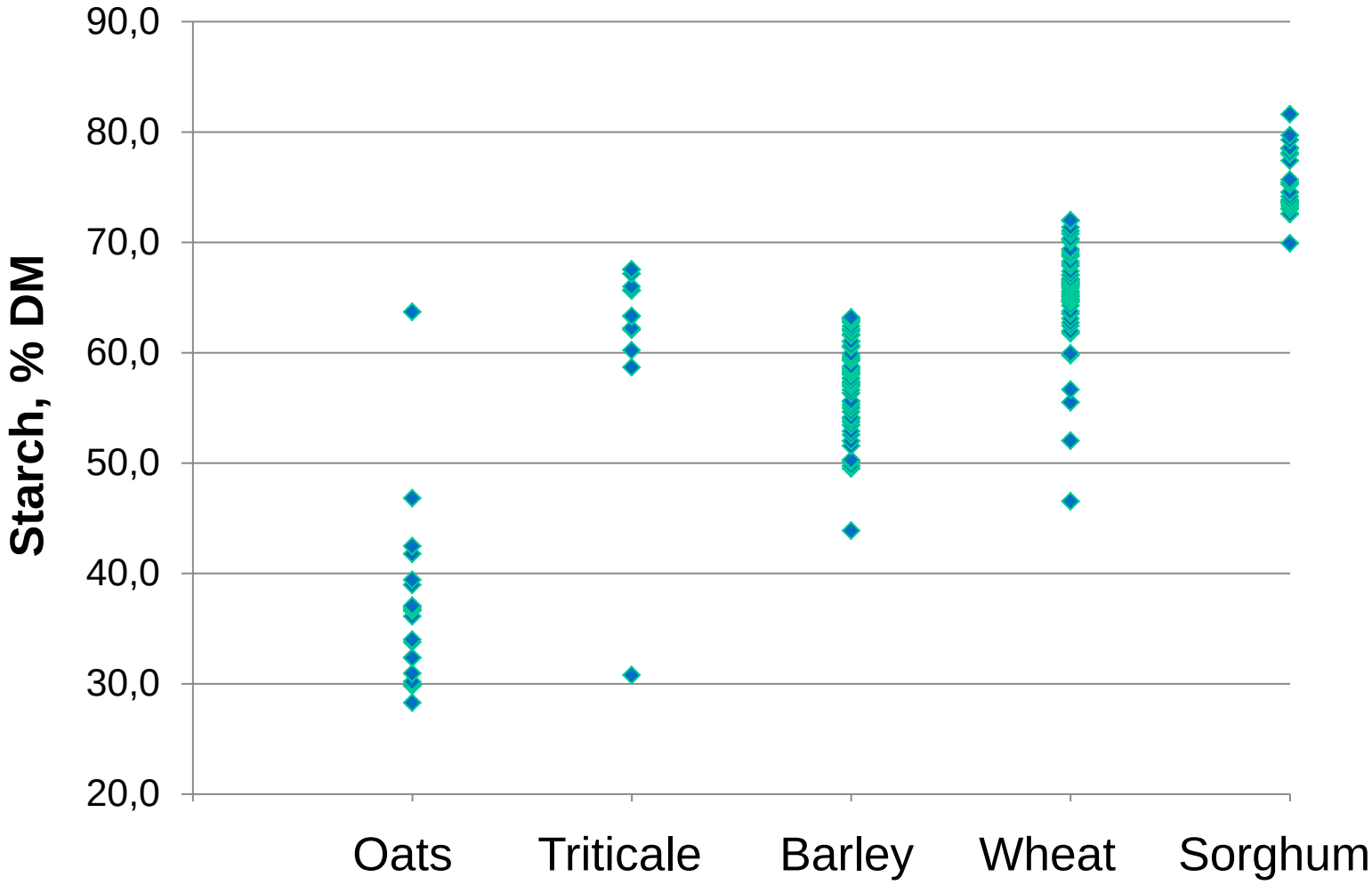

(Black, J. 2008, Pers comm. , Premium Grains for Livestock Program)

Background

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- The available energy of grains for ruminants is not always directly related to the starch content.

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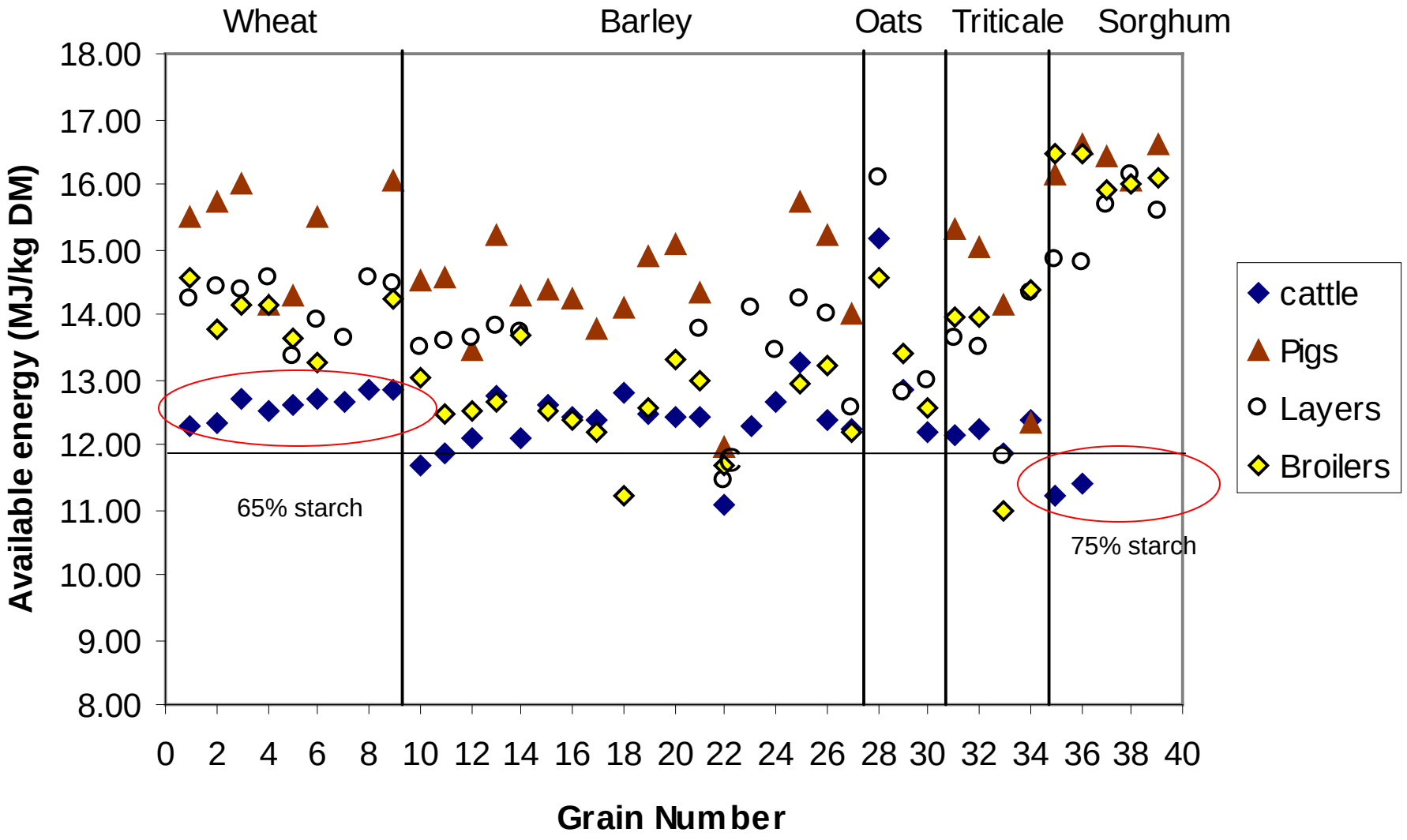
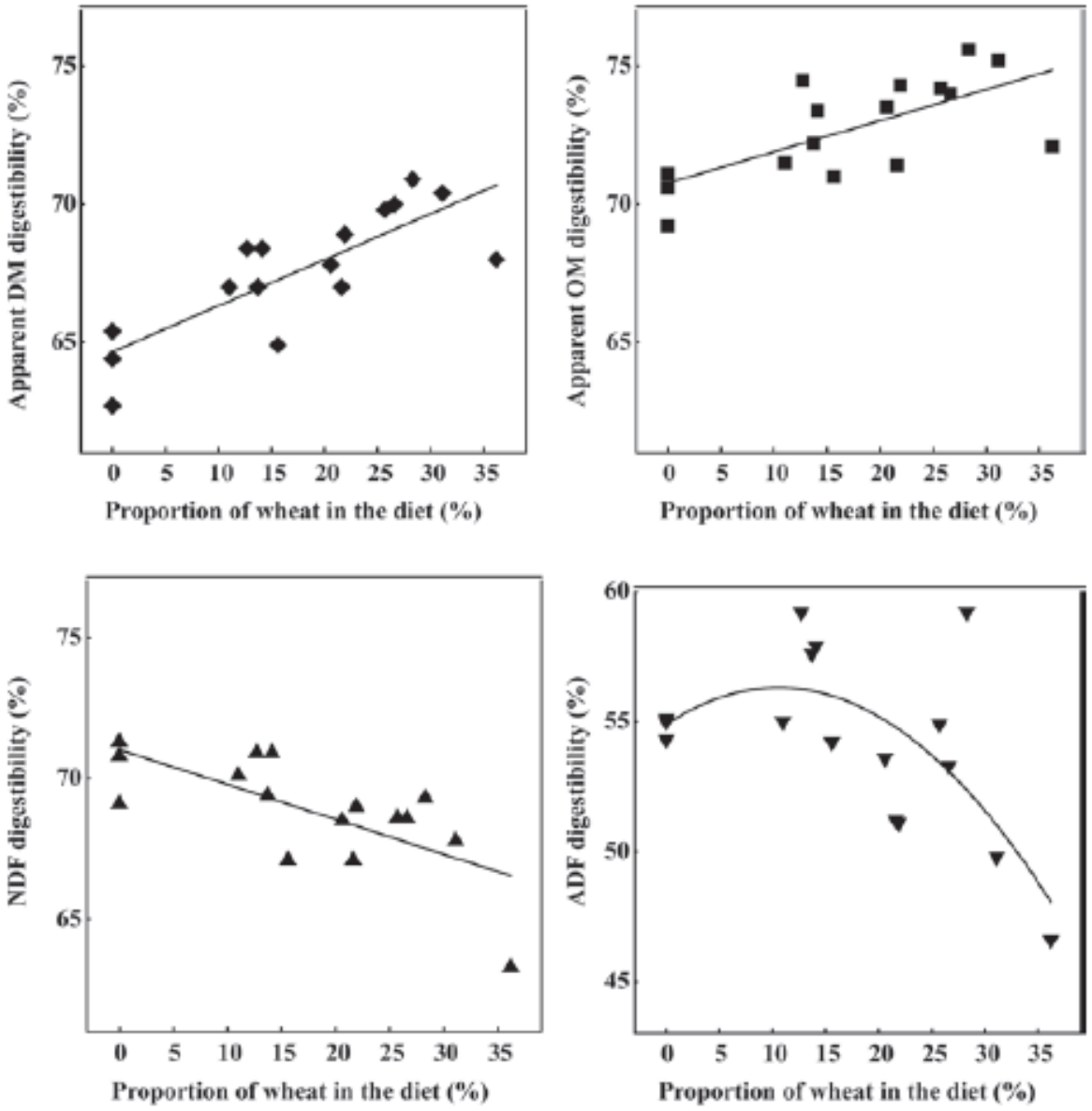


(Black, J. 2008, Final Report , Premium Grains for Livestock Program)

Background

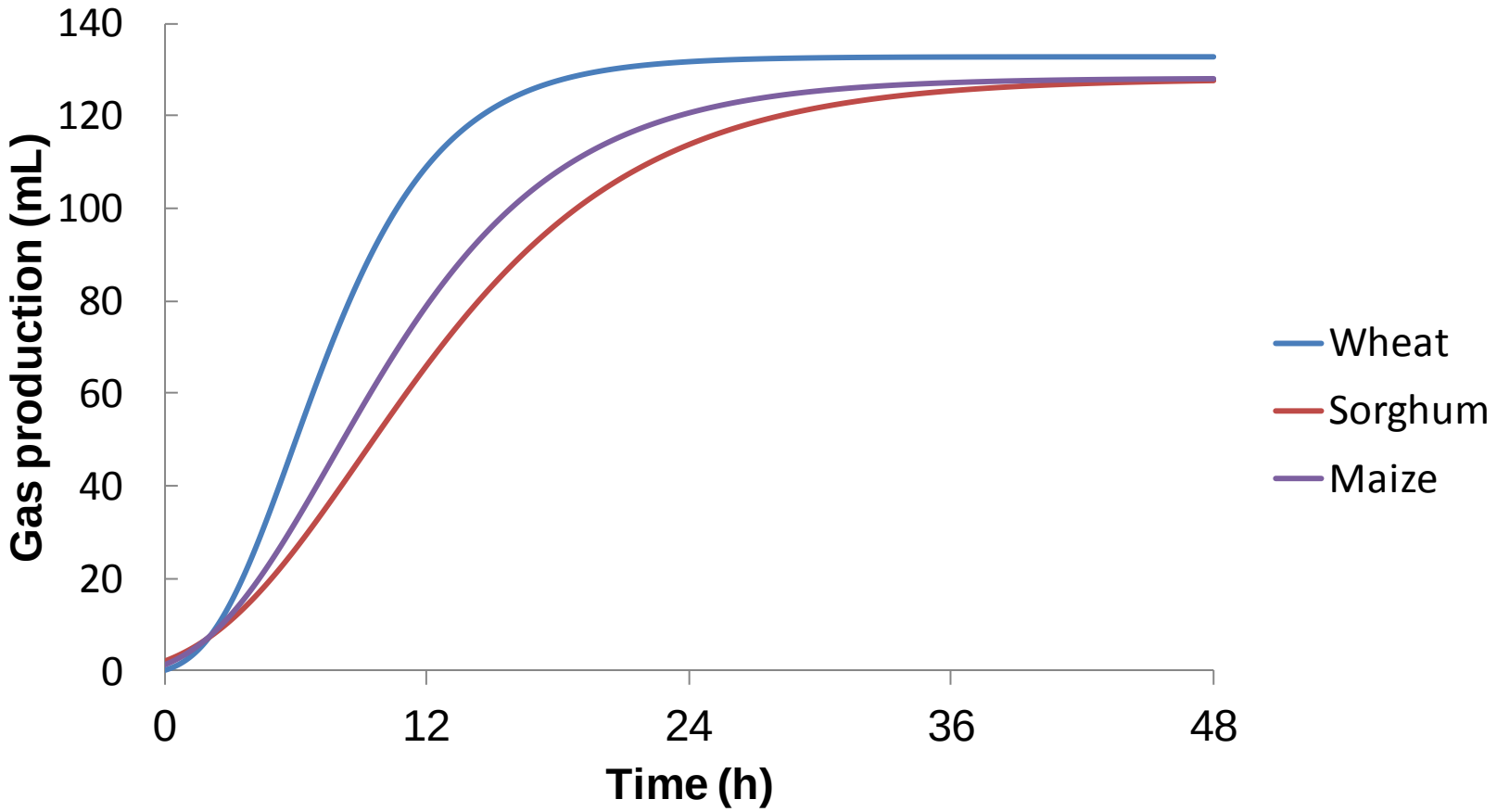
- There is variation in starch content between and within grains.
- The available energy of grains for ruminants is not always directly related to the starch content.
- Increasing the amount of rapidly fermentable starch can reduce fibre digestion and increase risk of sub-acute ruminal acidosis (SARA).

Increasing wheat in a diet decreases fiber digestion



Leddin *et al.* 2009

Wheat ferments faster than maize and sorghum



Background

- There is variation in starch content between and within grains.
- The available energy of grains for ruminants is not always directly related to the starch content.
- Increasing the amount of rapidly fermentable starch can reduce fibre digestion and increase risk of sub-acute ruminal acidosis (SARA).
- The site of fermentation or digestion can impact on the fate of starch and end products.

Bioprotect

- The active ingredient in Bioprotect is a stable non-volatile organic salt.
- Reacts with the primary and secondary amino groups of proteins and hydroxyl groups of starches.
- Starch and protein complexes are stable at neutral or slightly acidic conditions, as in the rumen (pH 5 to 7).
- Starch and protein complexes dissociate under more acidic conditions (pH 2 to 3) as in the abomasum and duodenum.

Hypotheses

- That the rate of fermentation of soft wheat is more rapid than hard wheat.
- That treatment of wheat with a starch binding agent will decrease it's rate of *in vitro* fermentation in a dose dependent manner.
- That the effect of a starch binding agent will be greater for soft wheat than for hard wheat

Experimental design

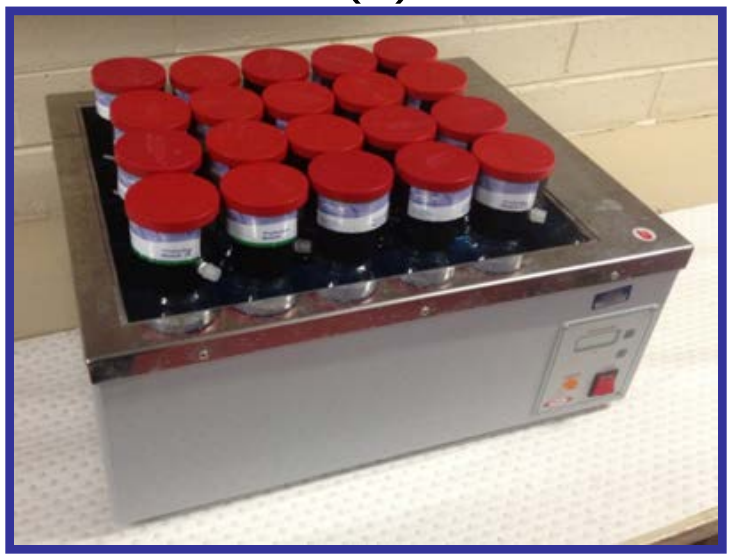
- Samples of hard white wheat, soft white wheat and and maize were ground and passed through a 1 mm sieve.

- Subsamples of ground hard and soft white wheat were mixed with Bioprotect™ (0, 4, 8 and 16 ml/kg).

Experimental design

- Samples (1.0 g) of the grain (n=16 for each grain) were added to serum flasks containing buffered rumen fluid and incubated at 39˚C for 48 h.

- Gas production was monitored using the ANKOM™ wireless system and fitted to a Gompertz equation to determine the maximum amount of gas production (Rmax) and the rate constant (²).



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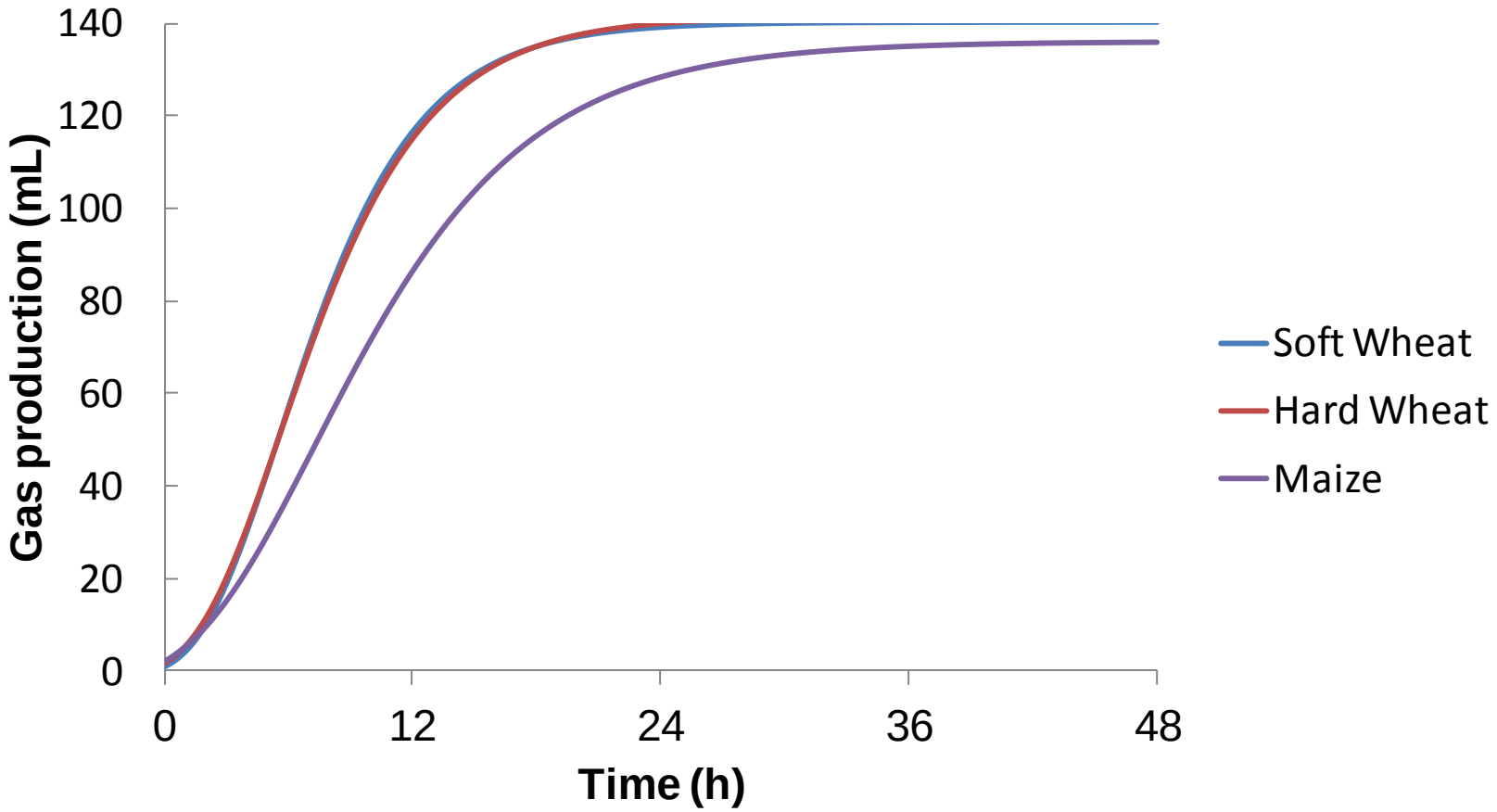
Wheat ferments faster than maize regardless of hardness



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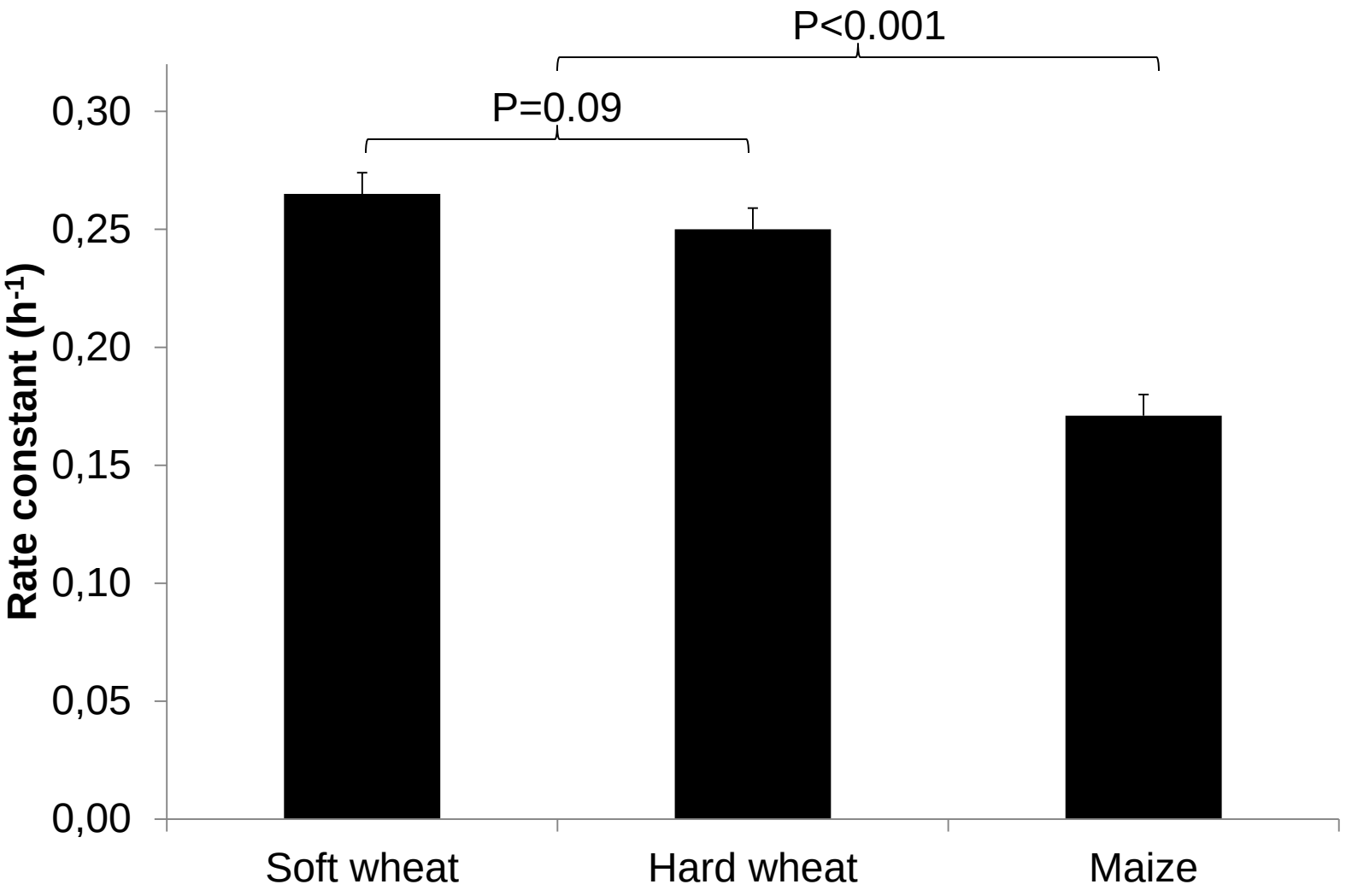
Hard wheat tends to have a lower β than hard wheat while maize has much lower β than wheat



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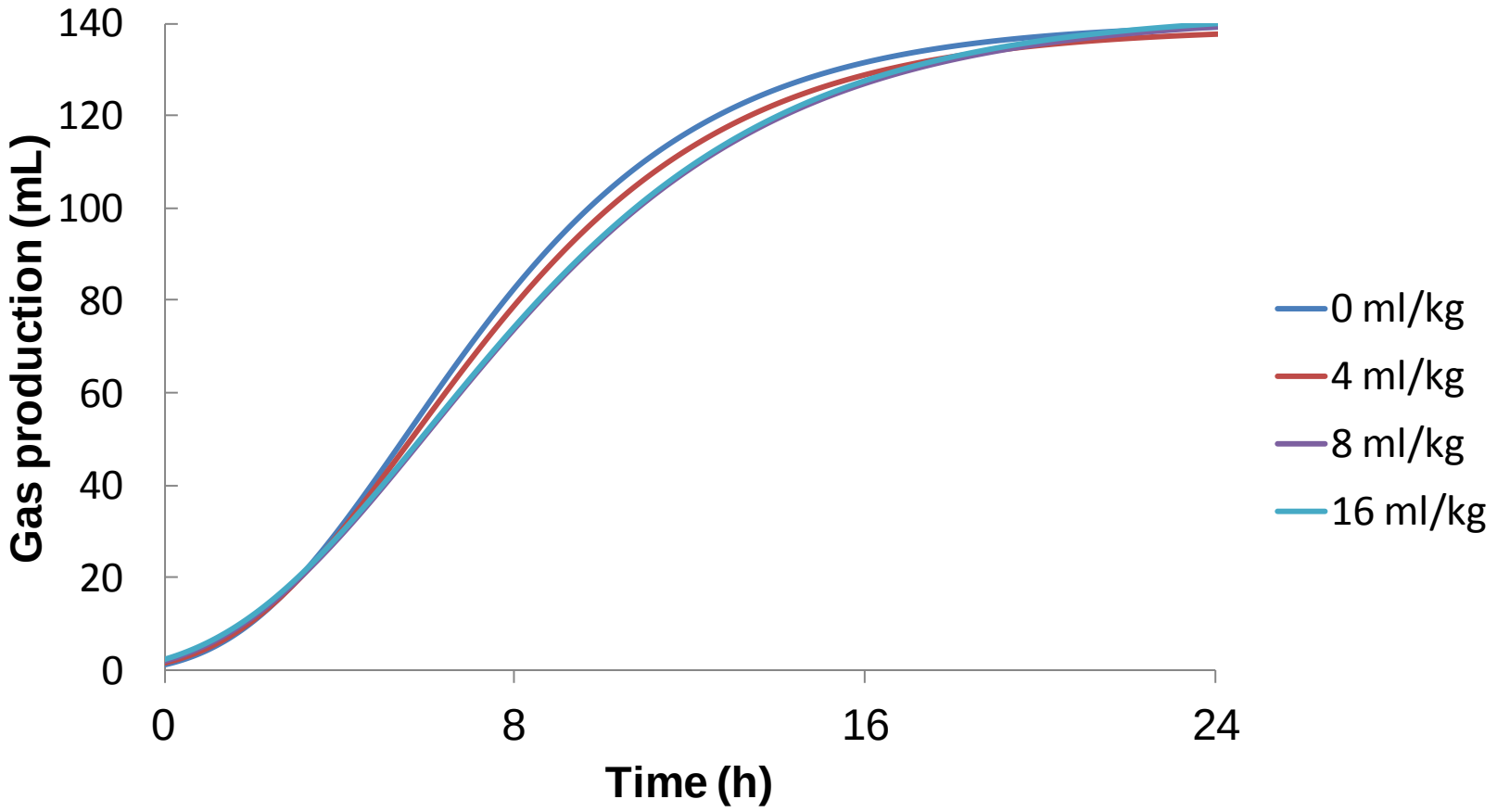
Bioprotect slows the fermentation of soft wheat



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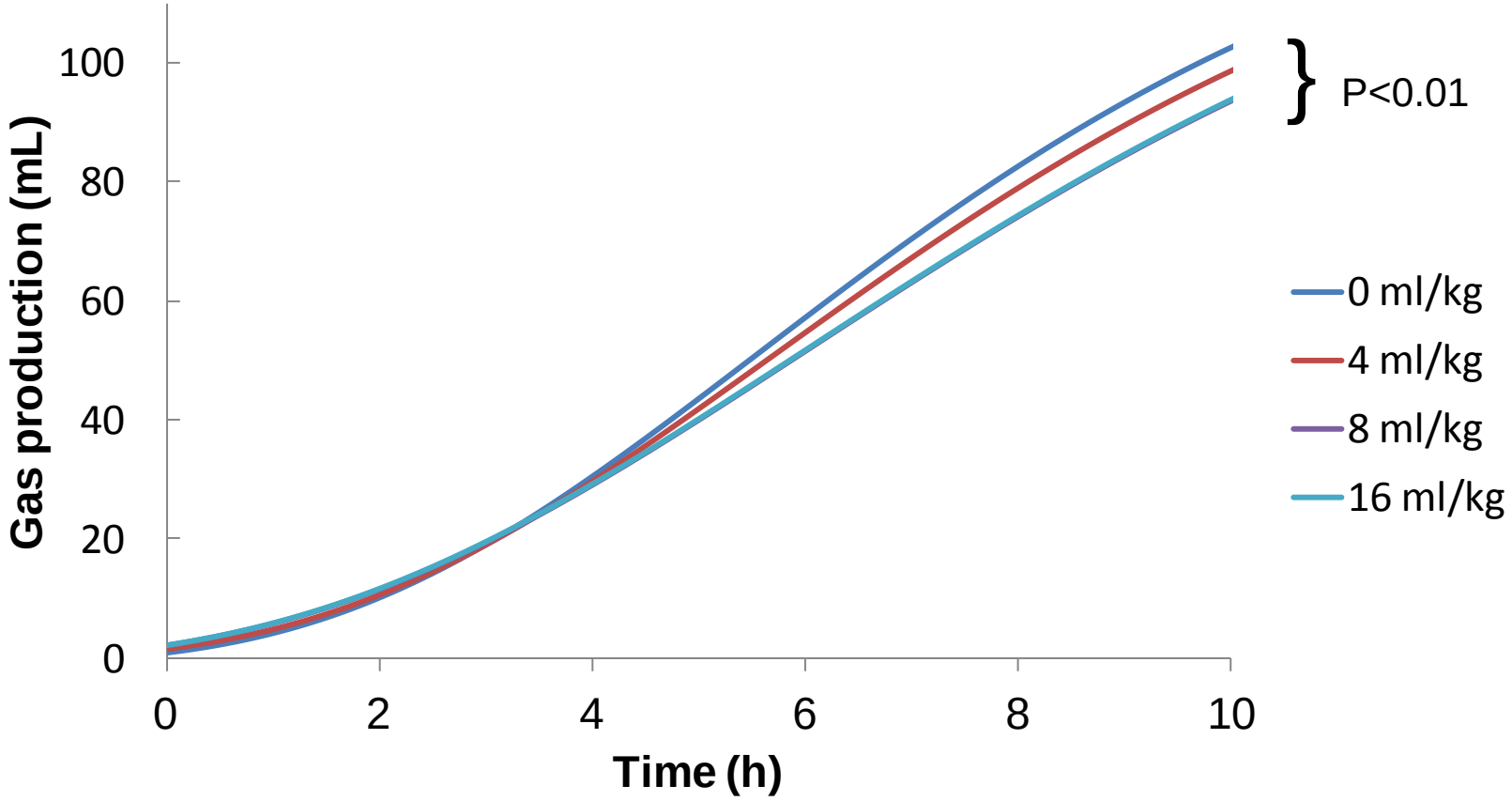

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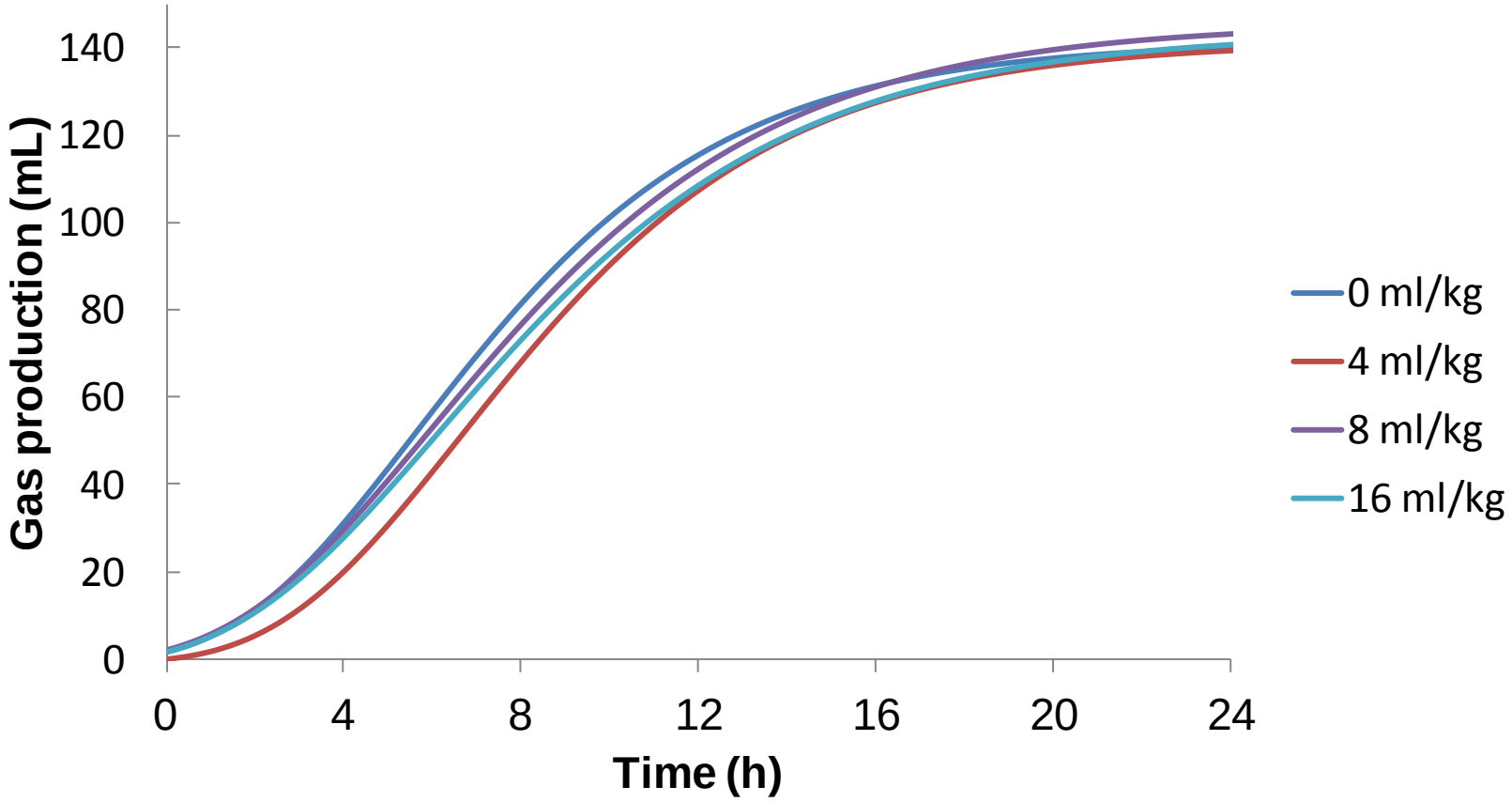

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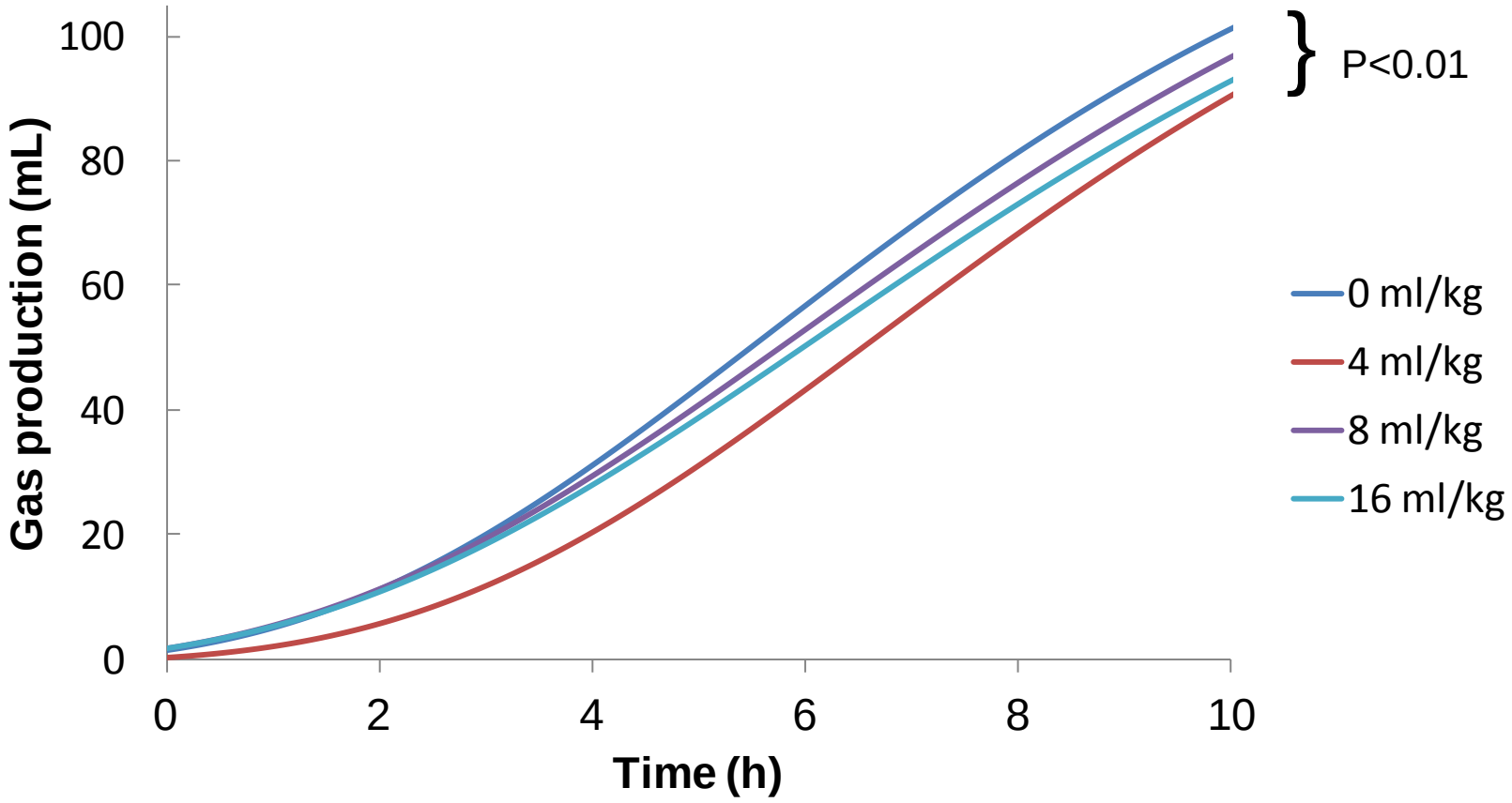

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Bioprotect decreases β in wheat in a dose dependent manner with the response maximised at 8 ml/kg

Hypotheses

- That the rate of fermentation of soft wheat is more rapid than hard wheat. √
- That treatment of wheat with a starch binding agent will decrease it's rate of *in vitro* fermentation in a dose dependent manner. √ response maximised at 8 ml/kg
- That the effect of a starch binding agent will be greater for soft wheat than for hard wheat √

Conclusions

- There is large variability in nutritive value between and within grains.
- High starch diets can lead to production losses.
- Need to optimise the ratio between rumen and small intestine digestion.
- Potential to use starch binding agents (eg. Bioprotect) to improve utilisation of wheat.