Altering nutrients supply modified dynamics of milk components synthesis in dairy cows

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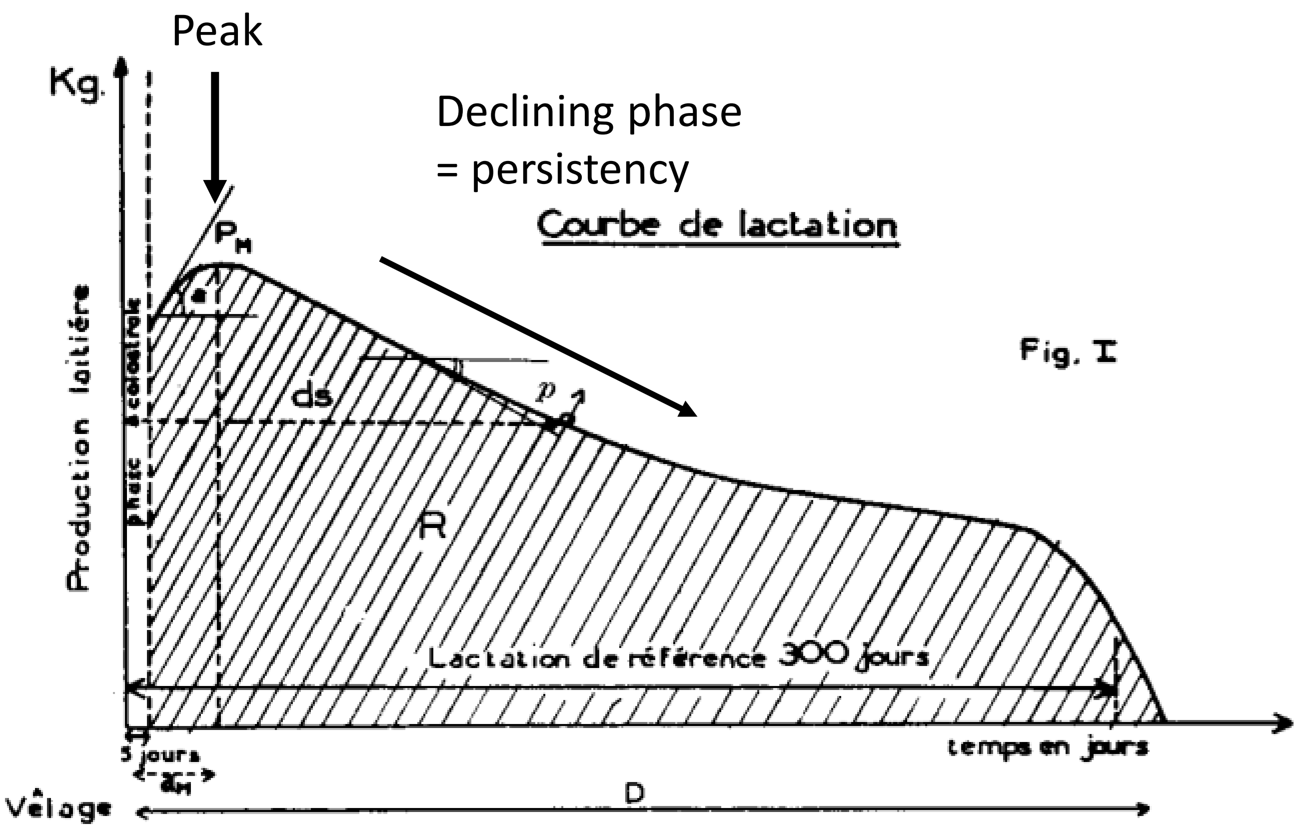
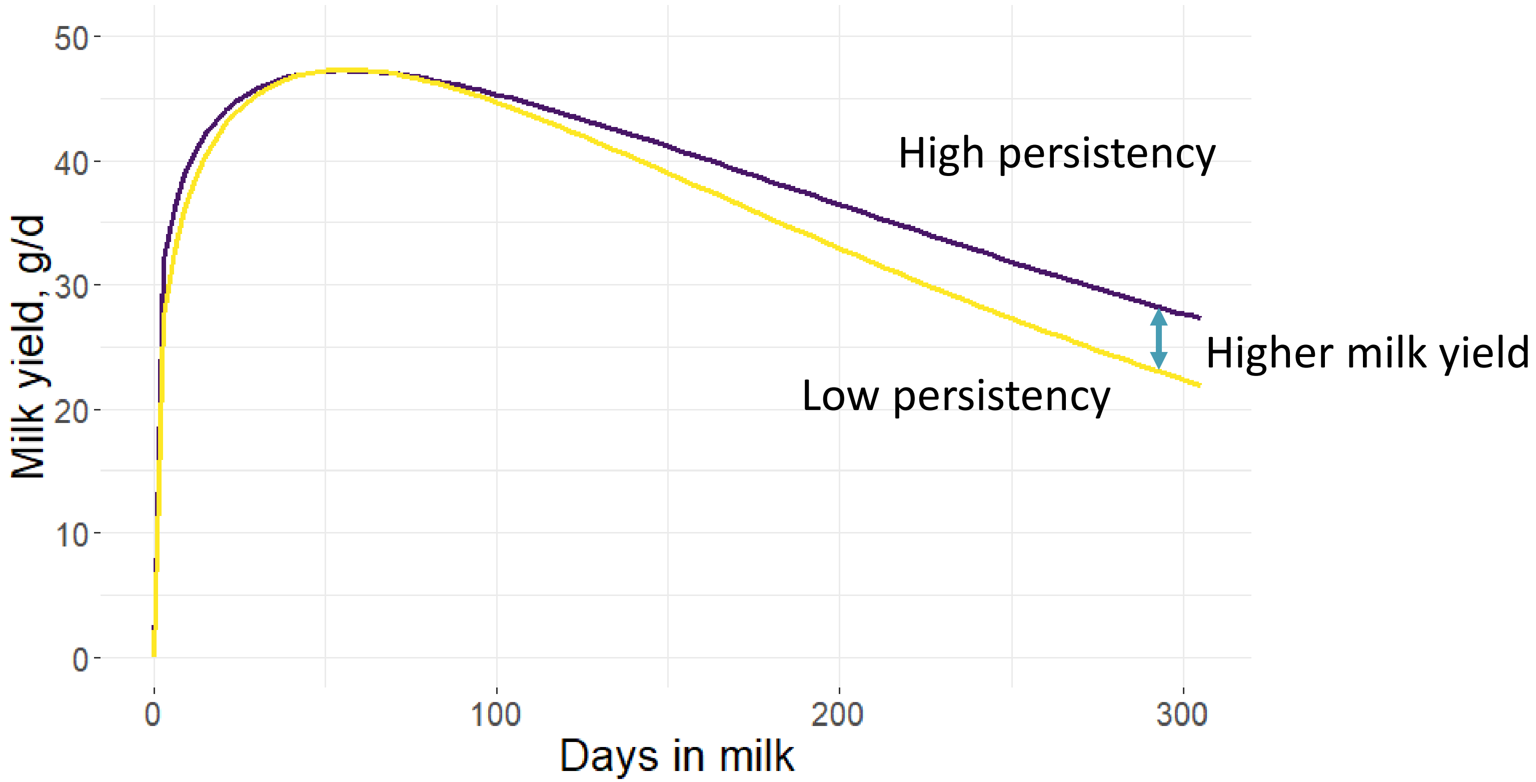
Milk yield varied along lactation



Delage & Leroy, 1953

Why increase persistency ?

Increasing milk yield over the whole lactation



High economic importance (Dekkers et al. 1998)

Increasing productive lifespan (Sehested et al. 2019)

How could persistency be improved?

Non-nutritional factors

- Genetics
- Seasons
- Parity
- Milking frequency

(Cannas et al. 2002)

Nutritional factors

- Modifying energy sources
  - Modify the energy partition between lactation and body reserve (Piccioli-cappelli et al, 2014)
- Supplementing with the most limiting amino acids
  - Increase mammary cells proliferations in vitro (Qi et al, 2018)

Aims and hypotheses

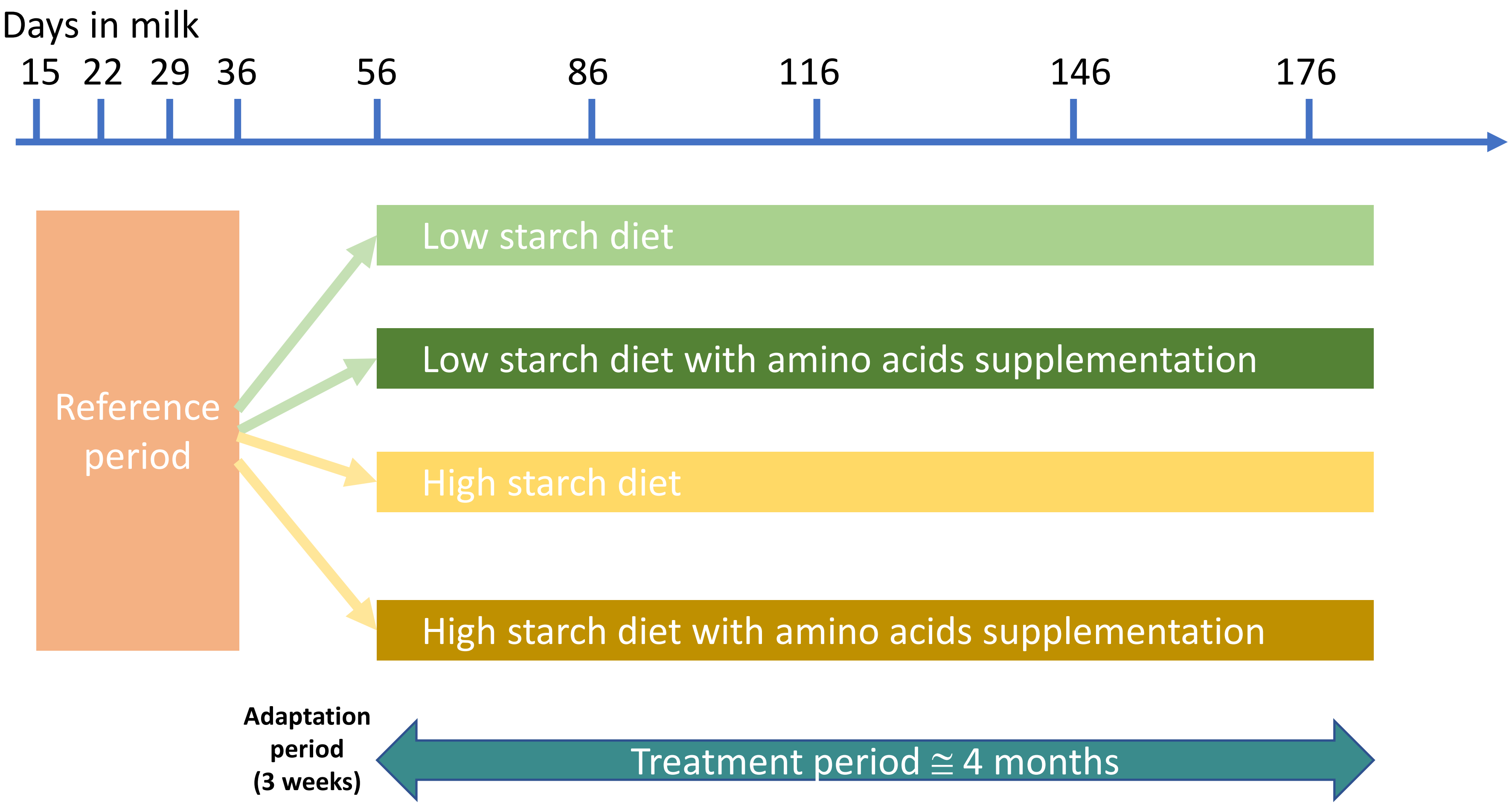
Aims:

Investigate the effect of starch and RP-AA (Lysine, Methionine and Histidine) on the persistency of milk and its components.

Hypotheses:

- Increasing starch in the diet could decreased persistency by increasing partition through body reserve
- Supplementing diet with RP-AA could increased persistency by increasing cells proliferation in mammary gland

Experimental design



11 cows including 8 multiparous by treatment

Diet nutritional values

	Low starch	High starch	Objectives
NEL (Mcal/kg DM)	1.57	1.48	Iso-ENL
CP (g/kg DM)	138	142	140 iso
MP (g of PDI*/kg DM)	88.8	93.5	90 iso
RUP (g/kg DM)	39.5	46.8	
RPB (g/kg DM)	-3.7	-3.0	-5 à +5
Starch (g/kg DM)	155	233	Difference of 100 g/kg MS
Intestinal glucose (g/d)	606	1278	
NDF (g/kg DM)	384	380	iso
NDF Digestible (g/kg DM)	208	177	

*Protéine Digestible dans l'intestin (INRA, 2018)

Amino acids treatments

Goals : Reach the optimal Amino acid supply according to INRA (2018) with RP-AA

RP-AA supplemented:

RP- Lys (AjiPro-L, Ajinomoto)

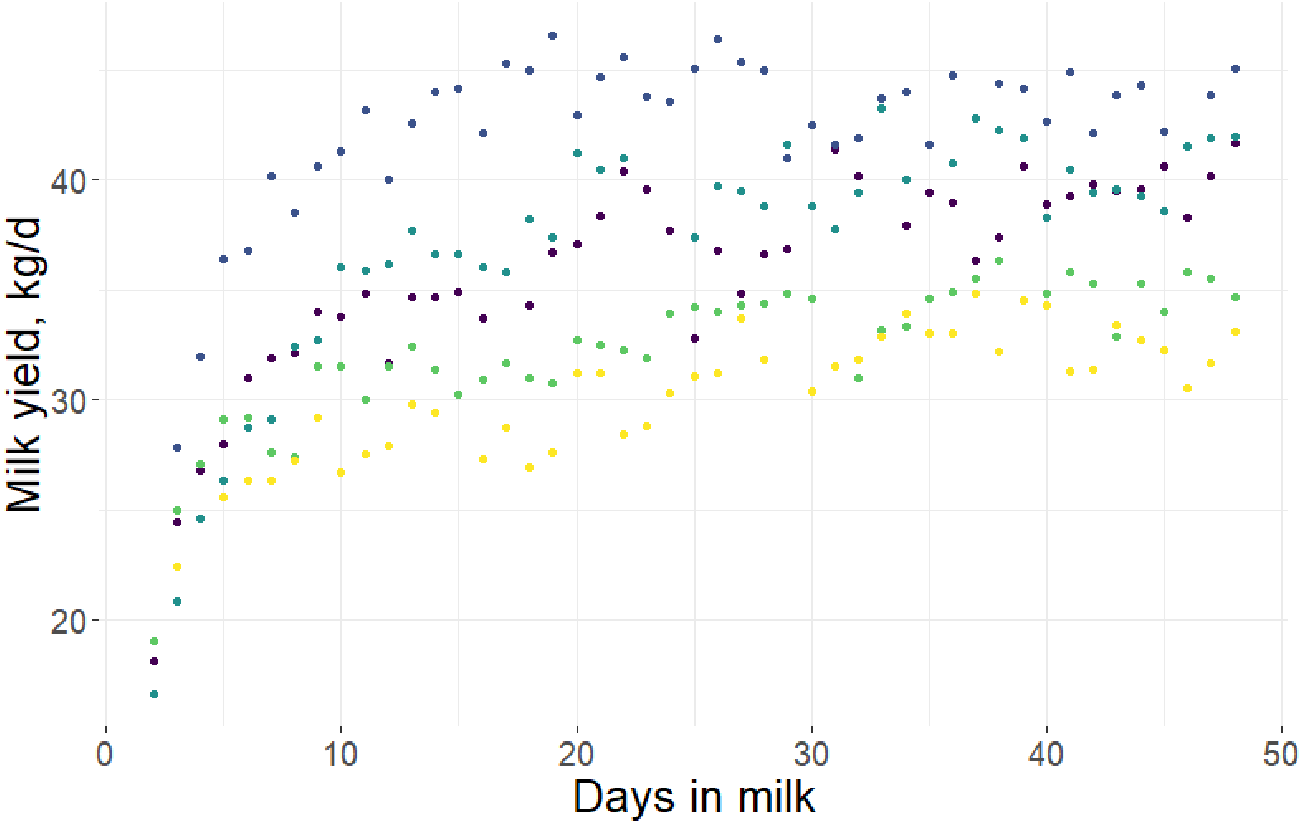
RP-Met (Smartamine, Adisseo)

RP-His (Ajinomoto)

	Low starch		High starch	
RP-AA supplementation	AA-	AA+	AA-	AA+
LysDI (% PDI)	6.4	7.2	6.4	7.0
MetDI (% PDI)	2.0	2.3	1.9	2.4
HisDI (% PDI)	2.0	2.3	2.2	2.4

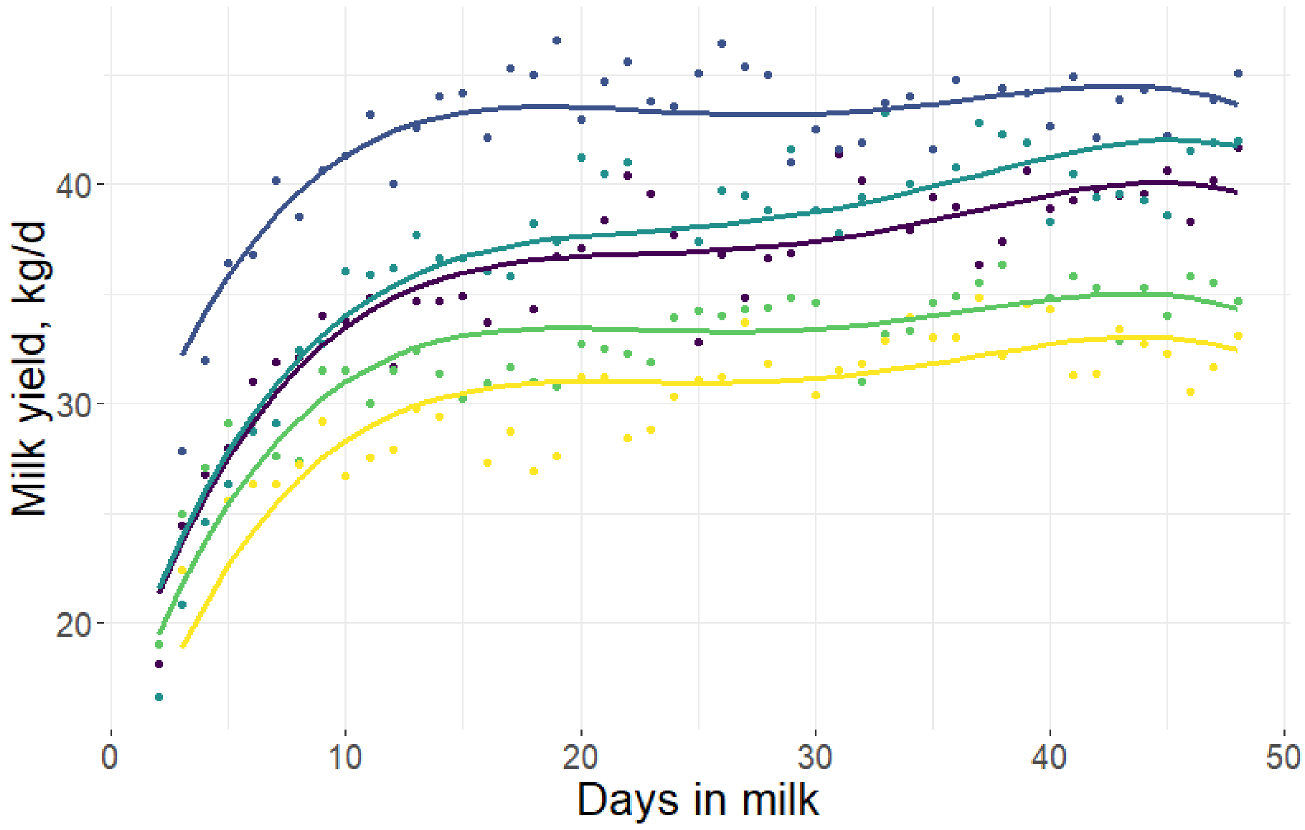
Estimation of covariate

Data were clean with spline method (Friggens et al. 1999)



Polynomial fitting with cows as random effect

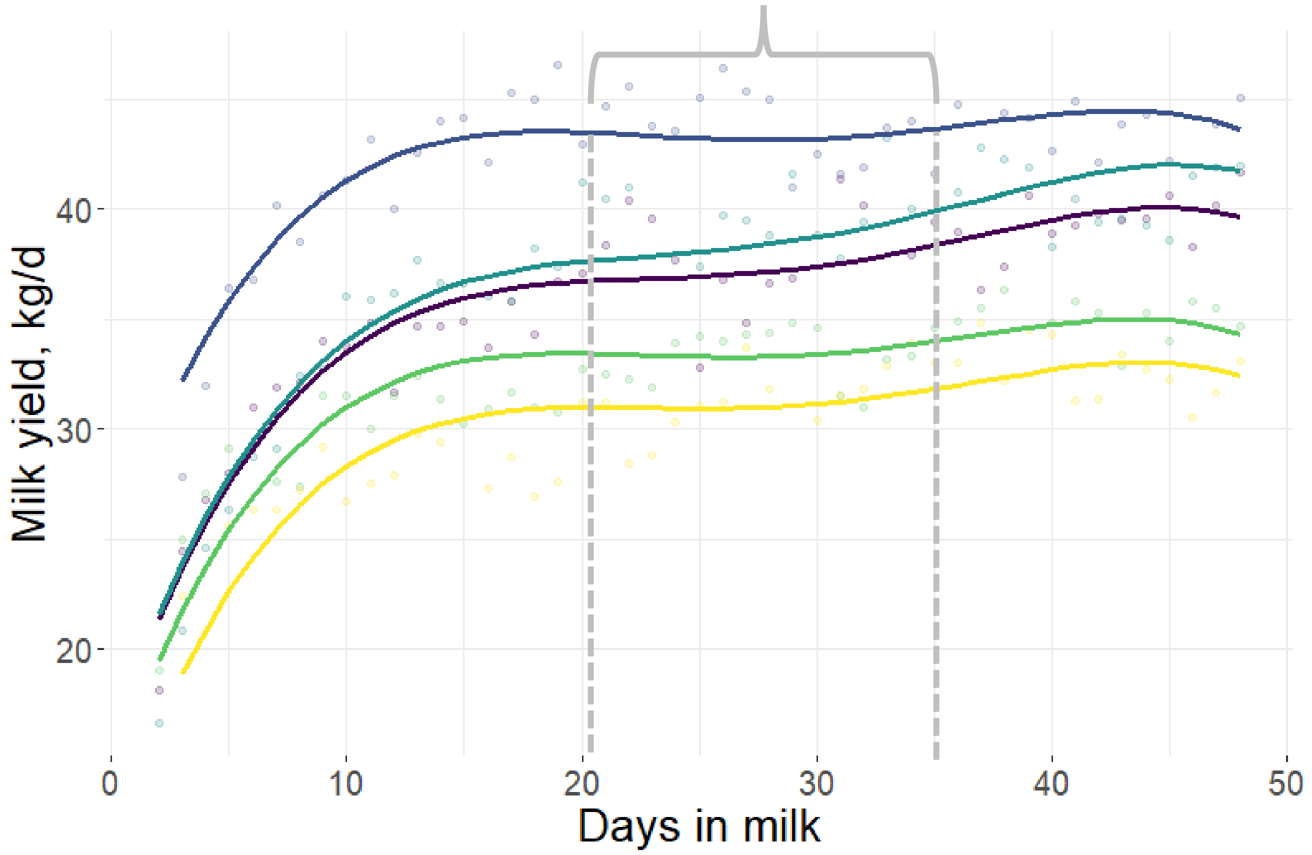
Estimation of covariate



Polynomial fitting with cows as random effect

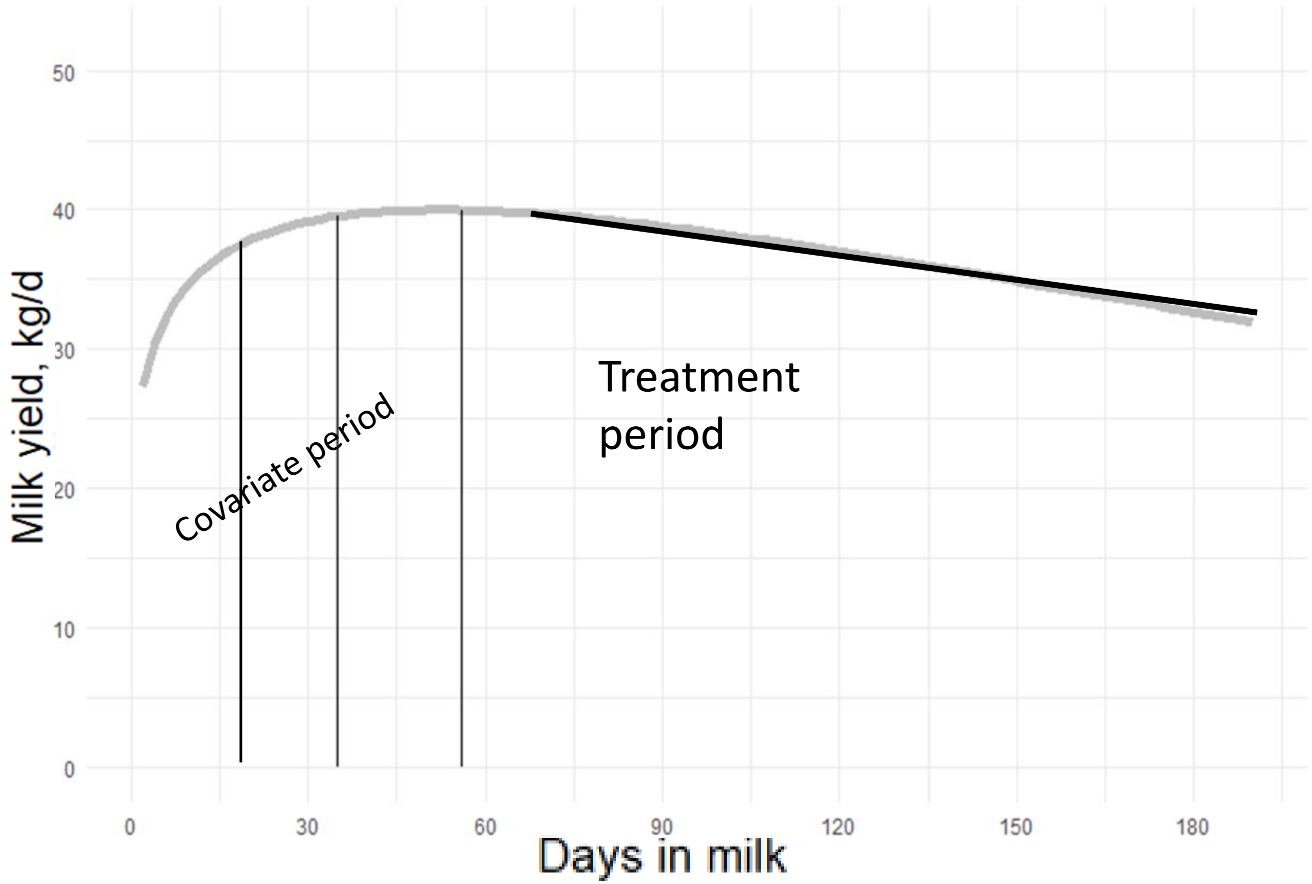
Estimation of covariate

Means of fitting values



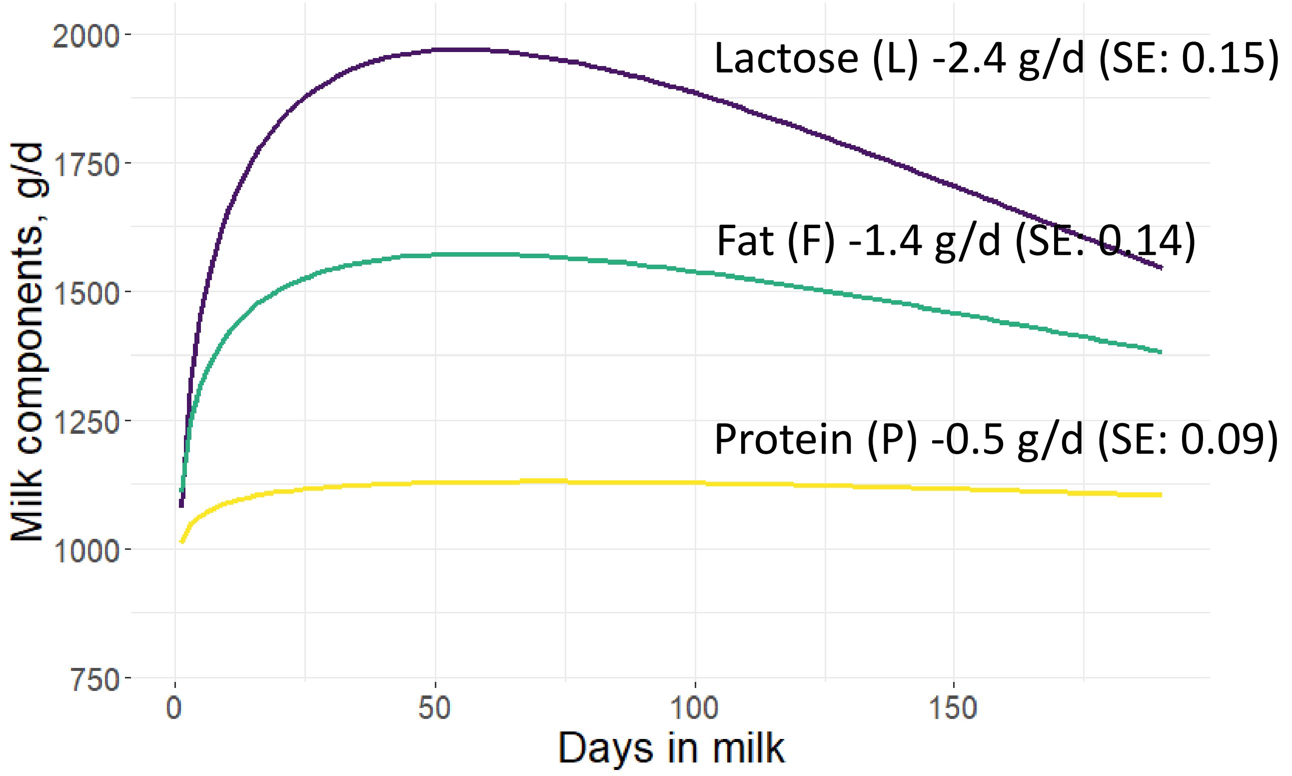
Polynomial fitting with cows as random effect

Data analysis



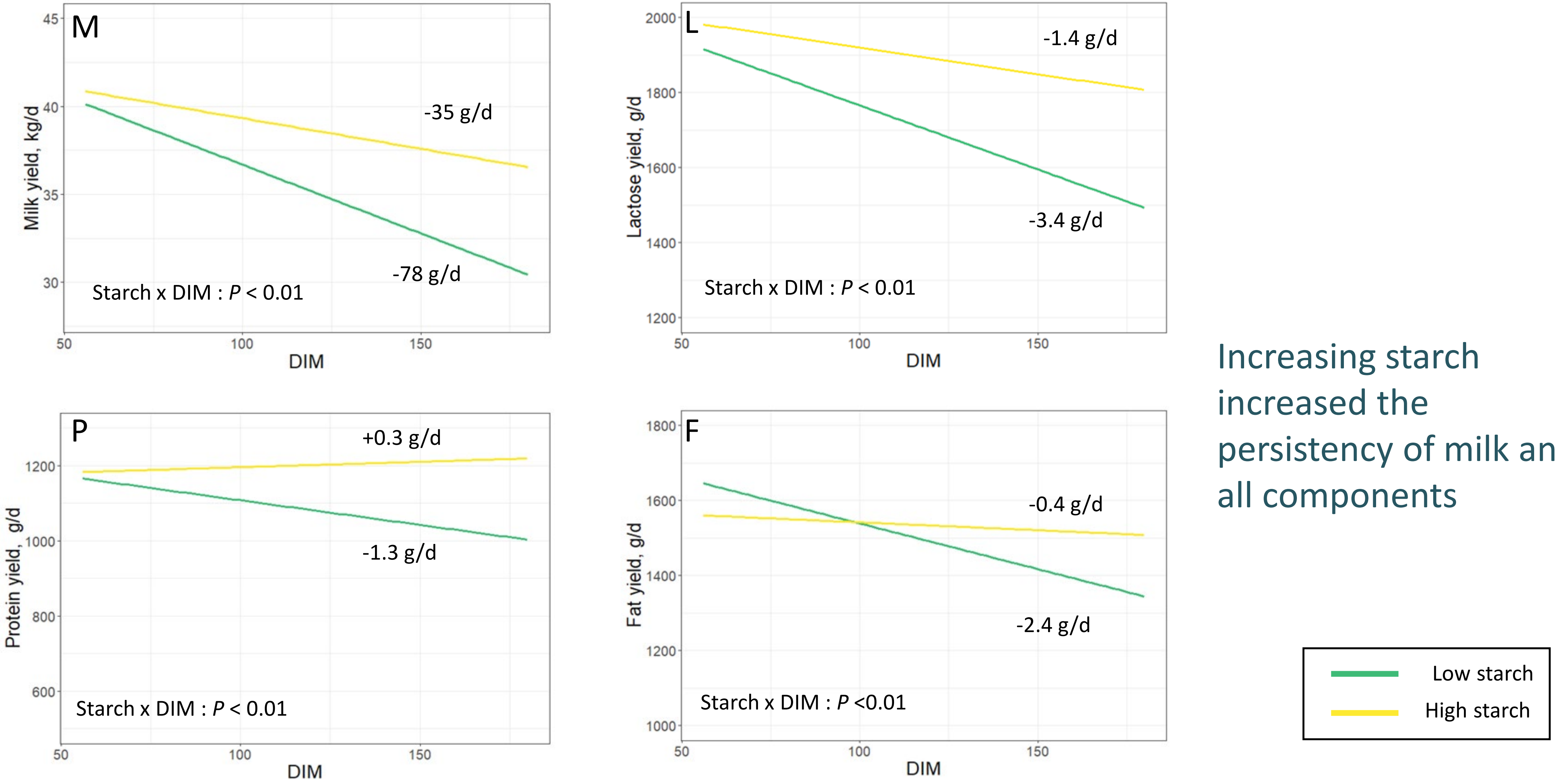
$$Y = covY + \beta_1 DIM + Starch + AA + Block + \beta_2 DIM \times Starch$$
$$+\beta_3 DIM \times AA + \beta_4 DIM \times Block + \beta_5 DIM \times Starch \times AA + Cow + \beta_6 Cows$$

Milk components didn't decrease at the same rate



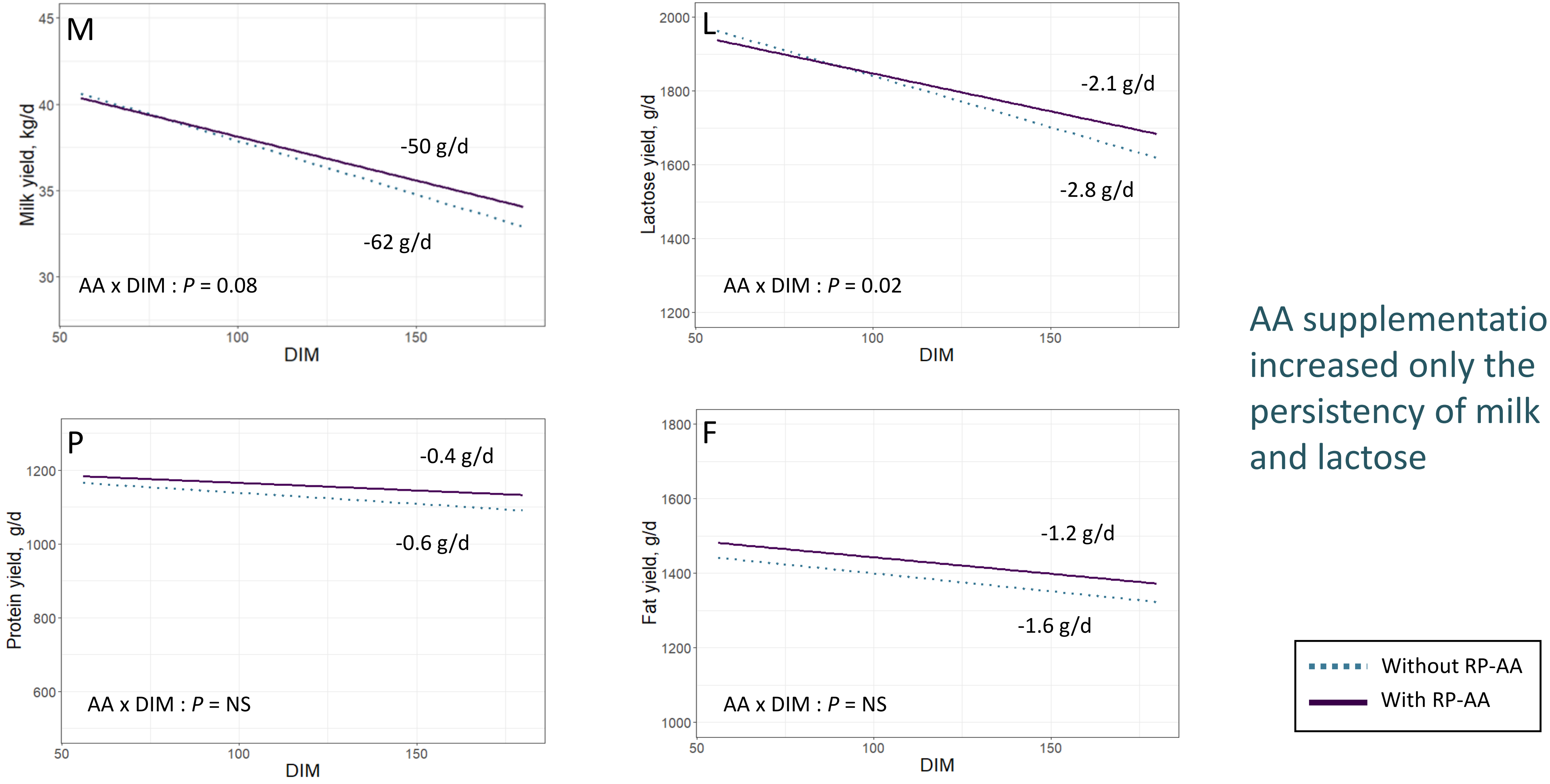
Analyze
the components
separately

Starchy diet increased persistency of milk and all components



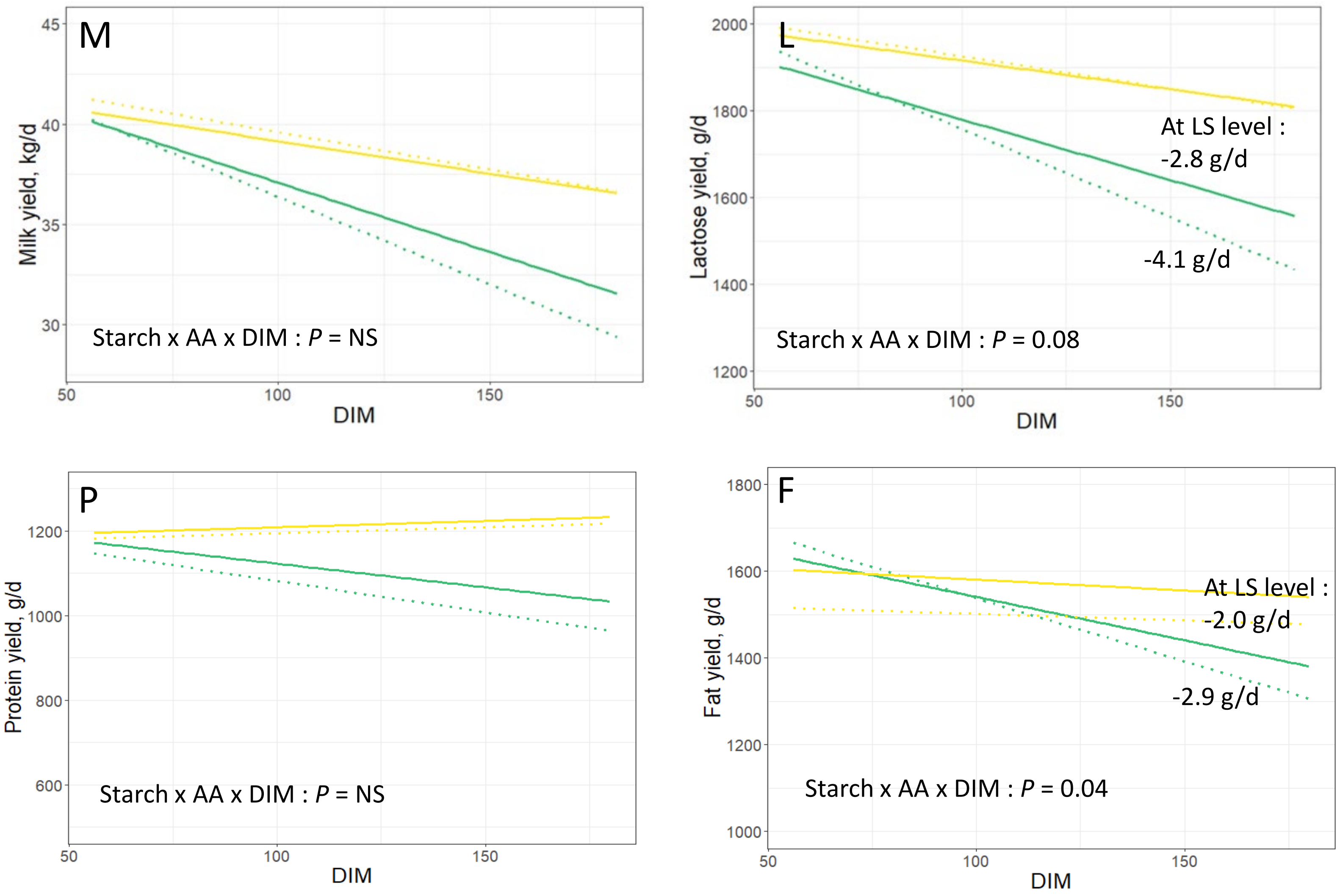
Increasing starch increased the persistency of milk and all components

AA supplementation increase milk and lactose slope



AA supplementation increased only the persistency of milk and lactose

But AA supplementation increased lactose and fat yield at low starch level



AA supplementation shown higher effect on persistency at low starch level

	Low starch	High starch
Without RP-AA		
With RP-AA		

Take -home message

- Contrary to our hypothesis, increasing starch increased persistency of all components.
- AA supplementation increased only the persistency of lactose yield but not protein yield.
- AA supplementation has higher effect on persistency in low starch diet.

This results could be due to an increase of stimulation of syntheses or an increase of cell proliferation in mammary gland by this nutrients

Altering nutrient intake allows to modify persistency but need study further in days in milk to confirm the effects of nutrient on persistency at the end of lactation

Thank you for your attention

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