

Comparison of Dairy Farming Systems: Indoor Feeding versus Pasture-based Feeding

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Objectives

- To compare indoor feeding to pasture-based feeding in dairy farming under the same conditions and within an equal agricultural area at the same time.
- Which feeding system is more efficient in terms of animal performance and the productivity of agricultural land, farm income and labour income?

Parts of the Project

- **Fodder crops**
- **Animal production**
- **Ecology**
- **Economics**
 - Milk quality and seasonality
 - Animal behaviour
 - Social aspects and values
 - Communication: knowledge transfer

Experimental design

Indoor feeding (IF) herd:

- 24 dairy cows, continuous calving
- Breeds: Brown Swiss, Holstein-Friesian (1:1)
- Milk performance goal: 8,500 kg lactation⁻¹
- TMR with maize/ grass silage and protein concentrate
- Concentrate according to requirements
- Average body weight of cows: 700 kg

Pasture-based feeding (PF) herd:

- 28 dairy cows
- Breeds: Brown Swiss, Swiss Fleckvieh (1:1)
- Milk performance goal: 6,300 kg lactation⁻¹
- Concentrate at the beginning of lactation: 280 kg cow⁻¹ lactation⁻¹
- Winter: hay ad libitum
- Semi-continuous pasture
- Average Body weight of cows: 600 kg
- Spring calving from February to April

On the same farm during 3 years (2008-2010) over the whole lactation

Indoor feeding (IF) herd



Pasture-based feeding (PF) herd



Agricultural Area

2008 – 2010	Indoor-herd	Pasture-herd	Yield
	ha		DM dt ha ⁻¹
Area for	mean	mean	mean
Agricultural (producing) area	15.80	15.70	
Pasture (enclosed) / hay	0.93	13.69	142
Grass silage	6.77		138
Maize silage ¹	2.89		177
Ecological compensating area	0.91	0.91	60
Fodder wheat and maize meal ^{1,2}	1.40	0.91	70.4/84.2
Soya bean meal extract (or cake) ³	1.71	0.11	31.5 (67%)
Maize gluten feed (corn) ³	1.20	0.05	63.7 (6.4%)

¹ only in 2008, mostly bought outside of the farm,; ² dry matter: air-dried matter x 0.89 ; ³ allocation to soya bean meal and maize

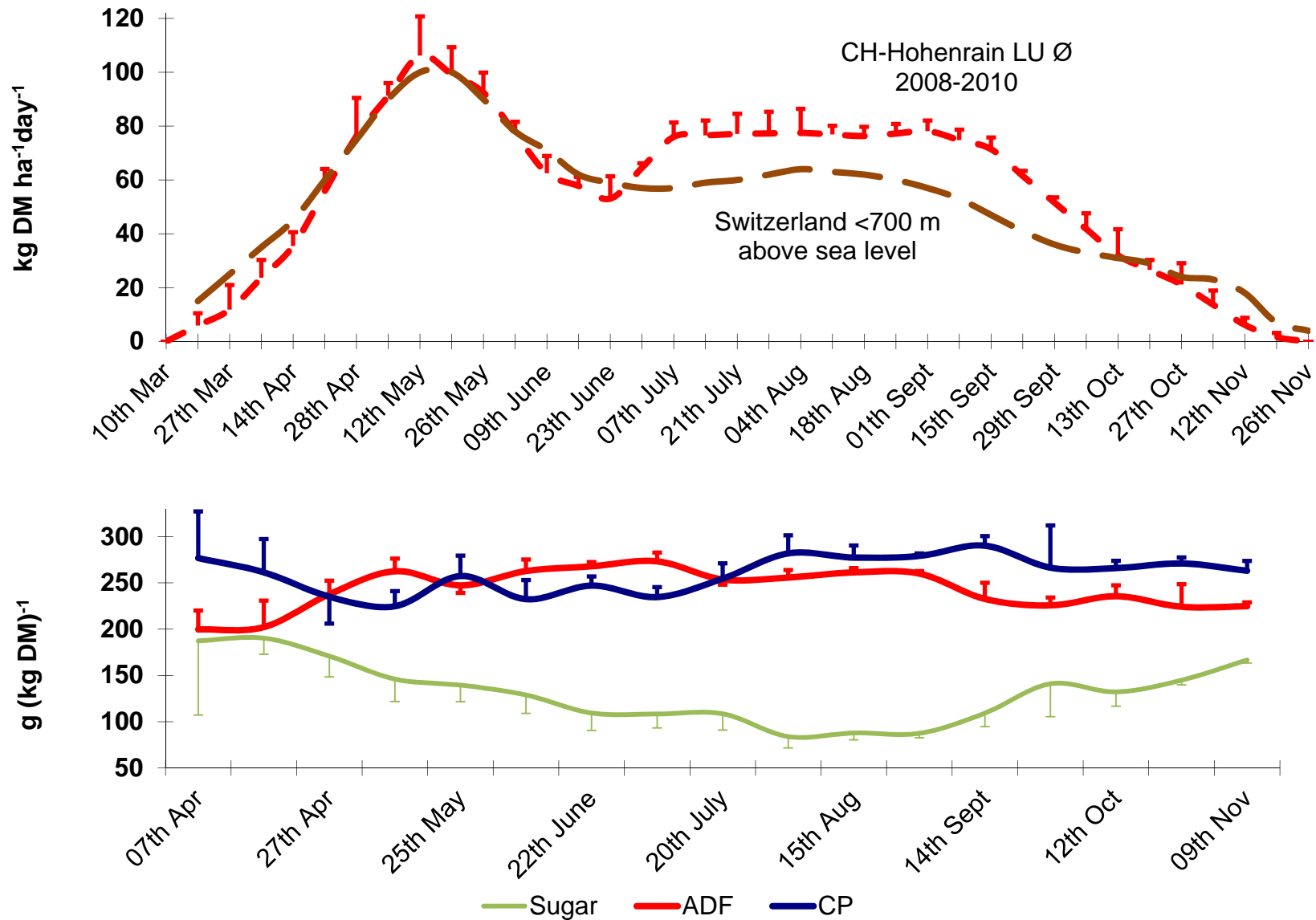
Farm

- 30 ha land
- 620 m above sea level
- 1200 mm precipitation
- Temperature 9.4 °C
- Playpen, milk shed



Results

Grass growth and nutrient content (mean a. \pm SD)



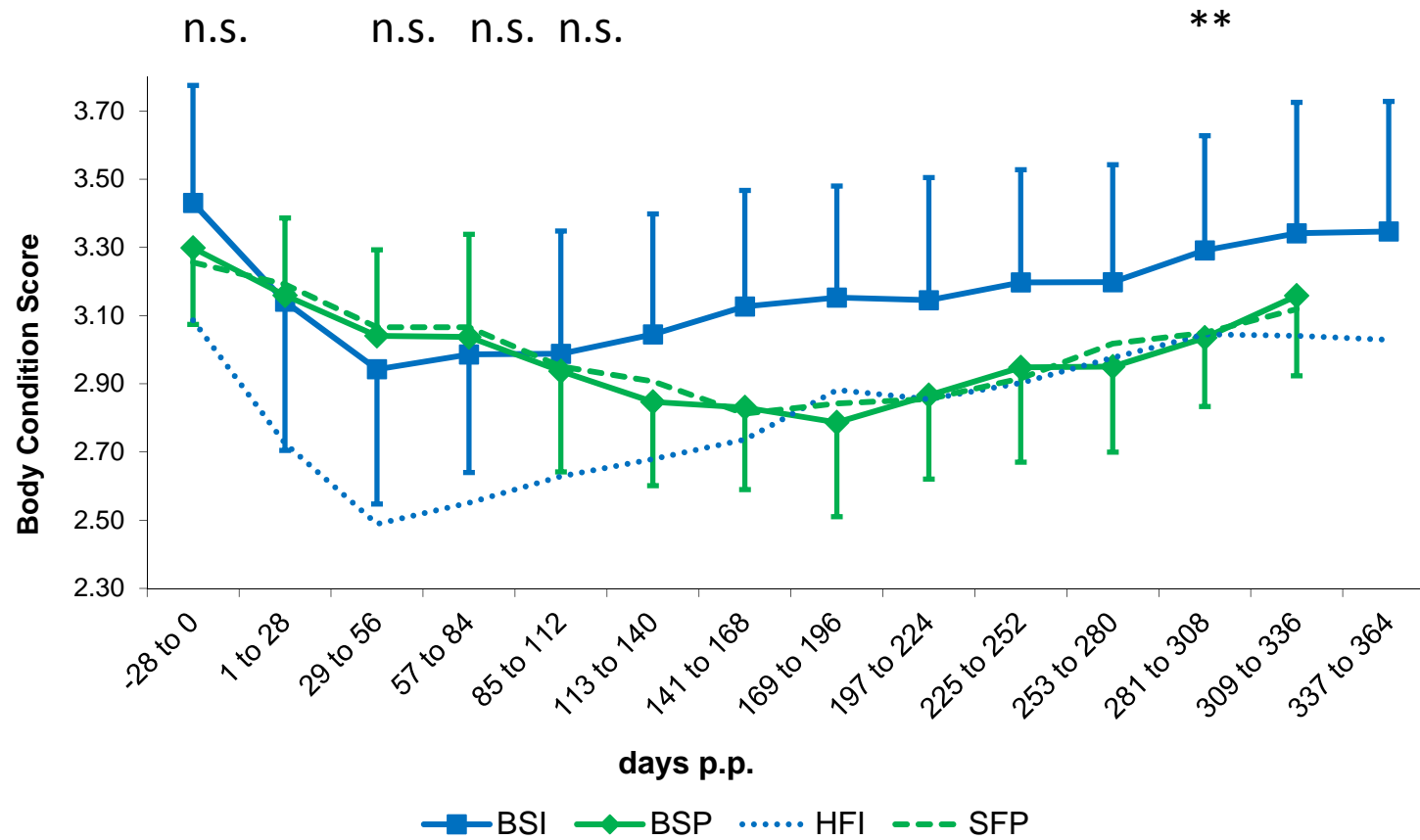
Grassland yield according to Corral and Fenlon (1978): 142 (\pm 4.9) dt DM y⁻¹ resulted from four separated sites.

Duration of lactation, milk yield and milk solids per cow

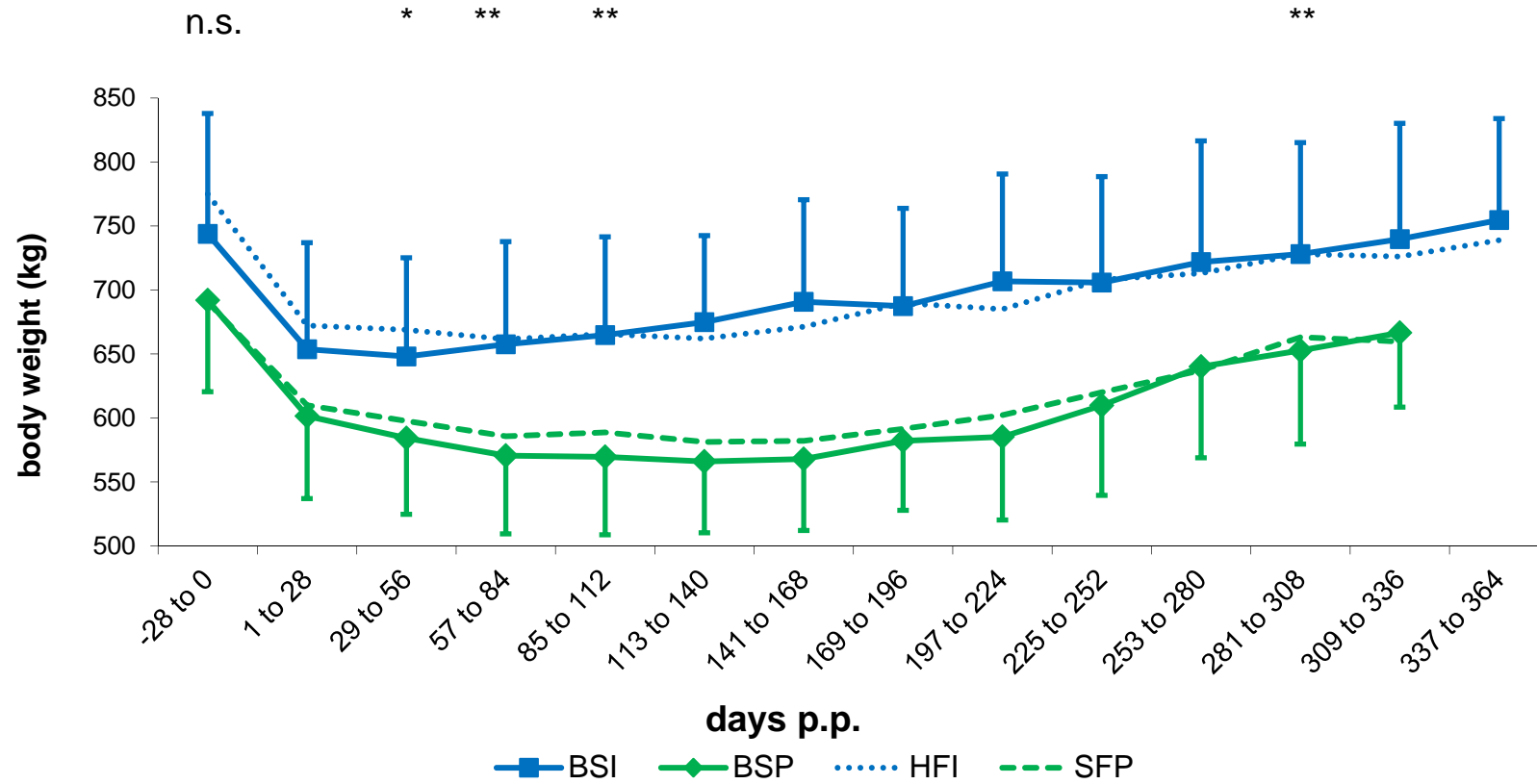
	Brown Swiss				P-value FS ¹ Y ² FSxY	Holstein- Friesian		Swiss Fleckvieh			
	BS-Indoor		BS-Pasture			mean	±SE	mean	±SE		
	mean	±SE	mean	±SE							
Duration of lactation, d	302	1.2	296	1.9	*	n.s.	n.s.	300	1.8	292	2.0
ECM, kg	8750	259	5610	170	**	*	n.s.	9422	299	6082	164
milk fat, kg	350	11.2	213	7.2	**	n.s.	n.s.	380	13.1	240	6.8
milk protein, kg	306	8.1	203	5.6	**	*	n.s.	317	9.3	209	5.7

¹FS: feeding system, ²Y= year

Body Condition Scores (BCS, mean and \pm SD)



Body Weight (mean (kg cow⁻¹) and ± SD)



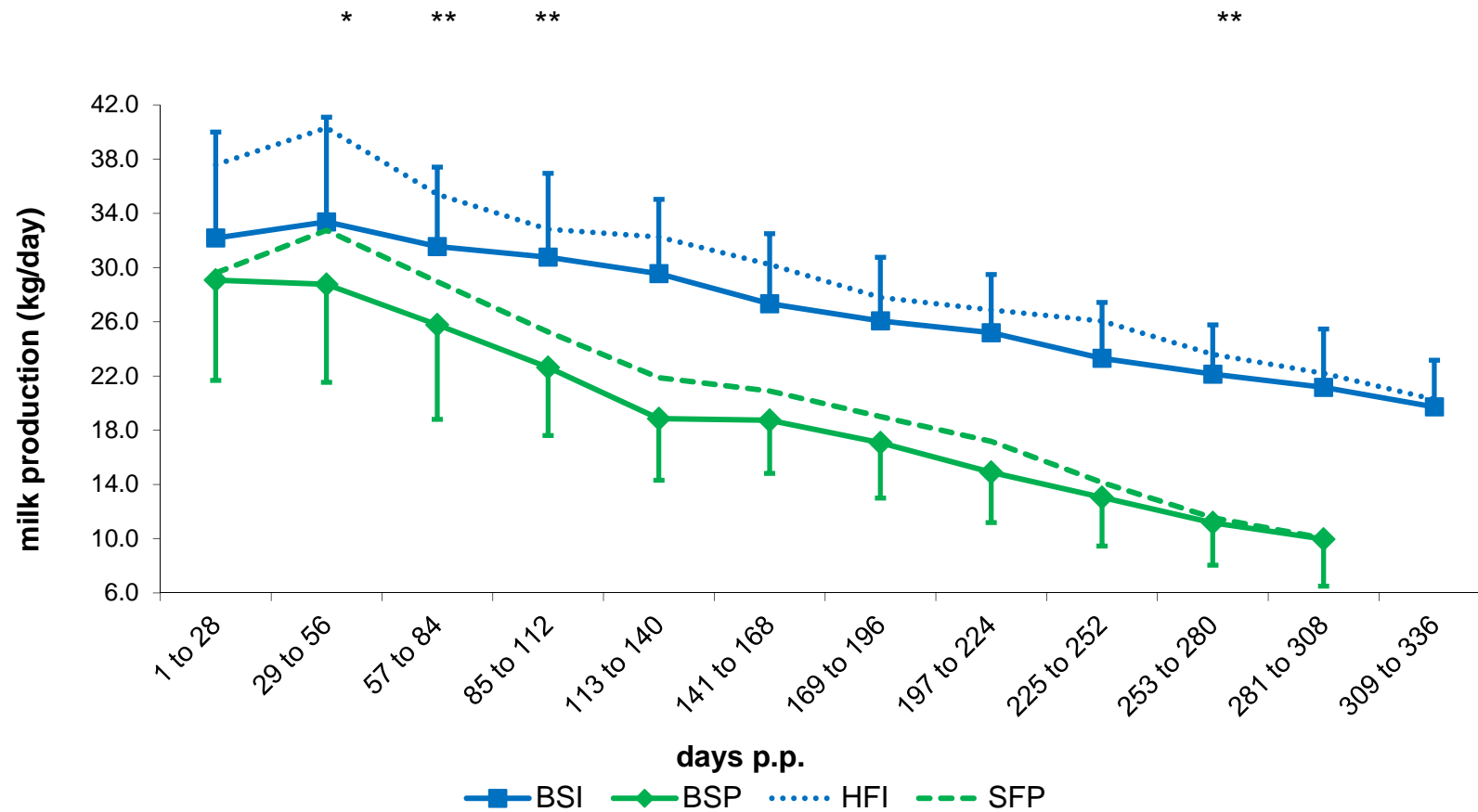
BSI: 697 (±89.8) kg

BSP: 607 (±75.3) kg

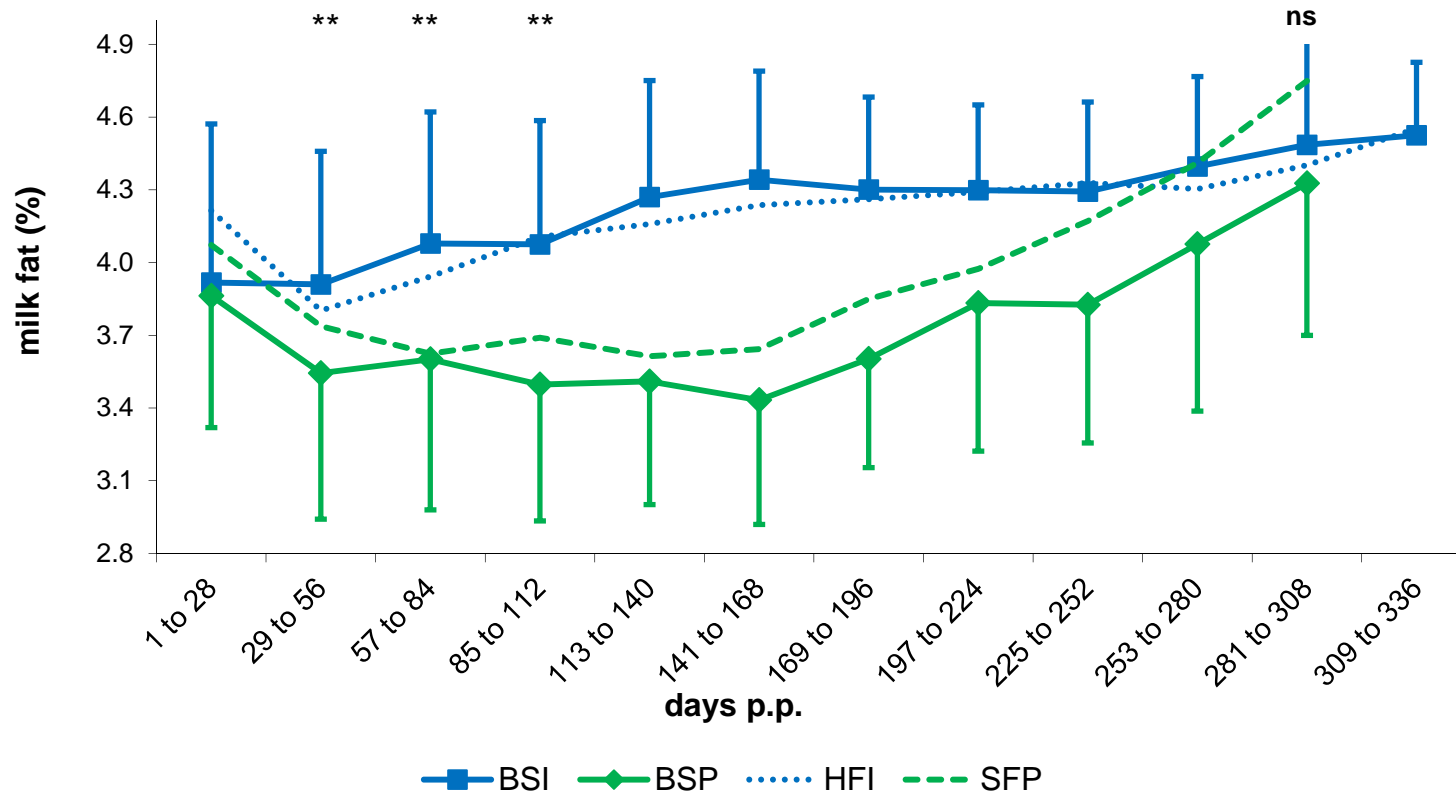
HFI 700 (±84.4) kg

SFP 617 (±68.4) kg

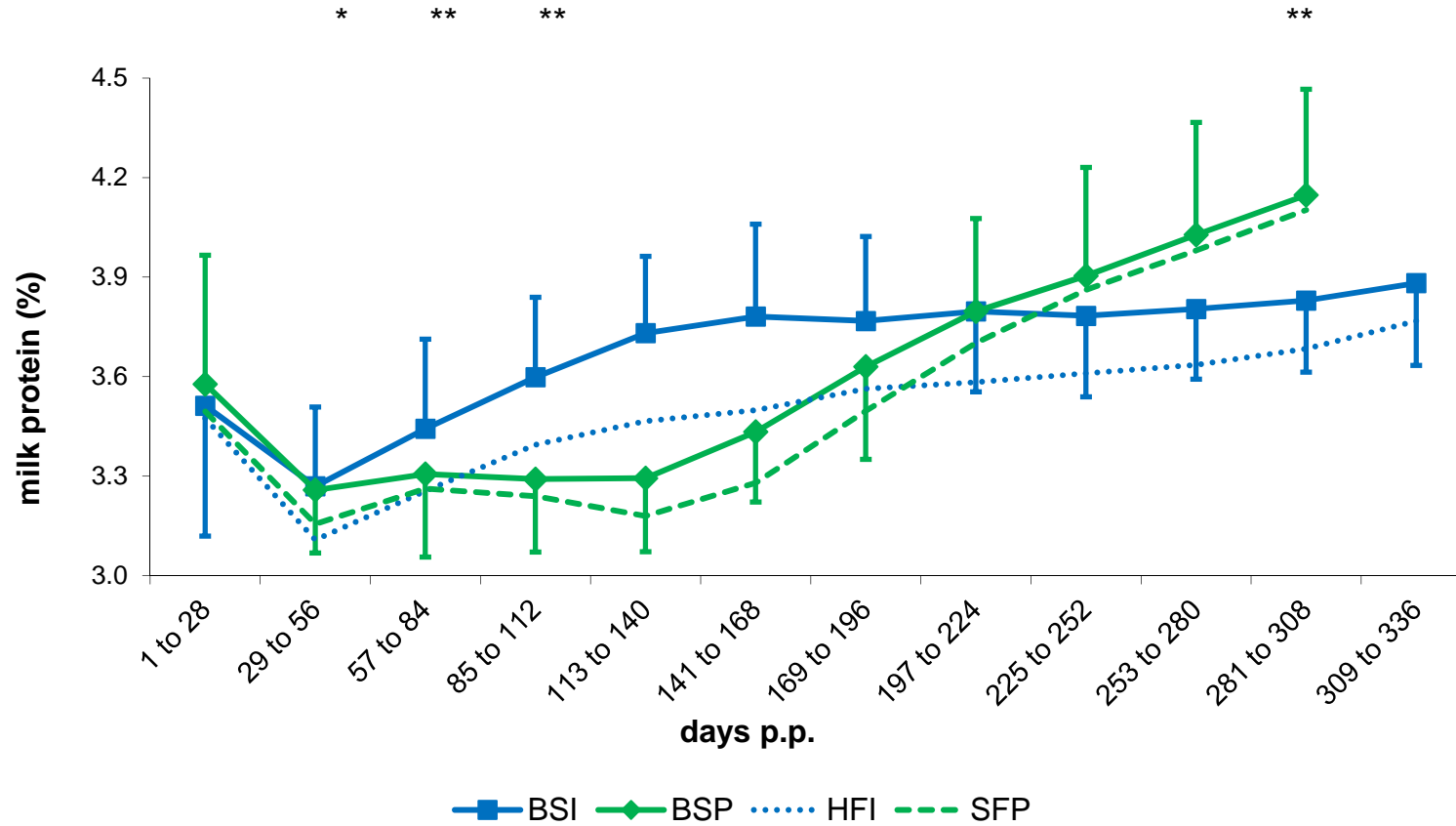
Milk Yield (kg ECM, mean and \pm SD)



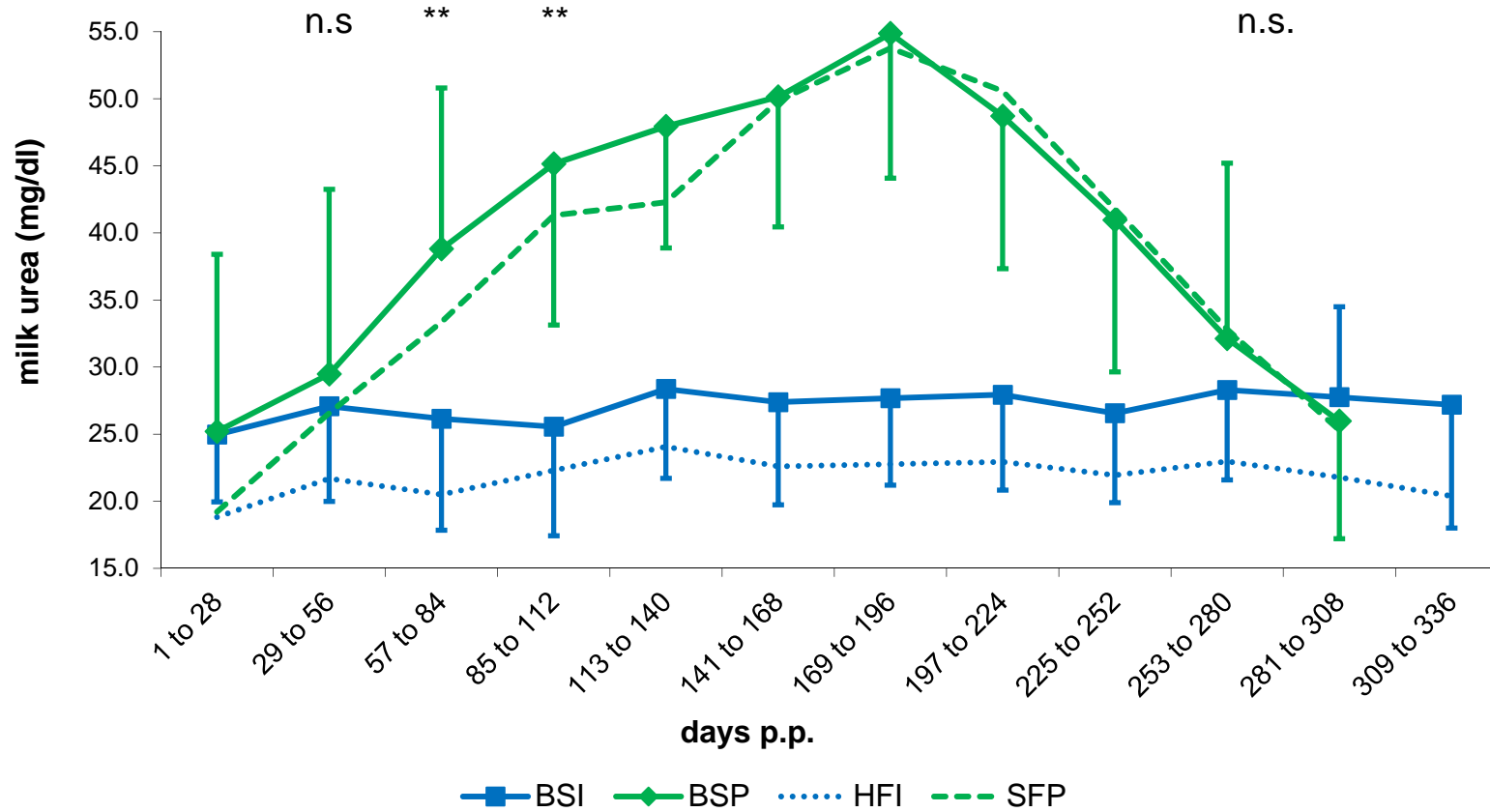
Milk Fat (% , mean and \pm SD)



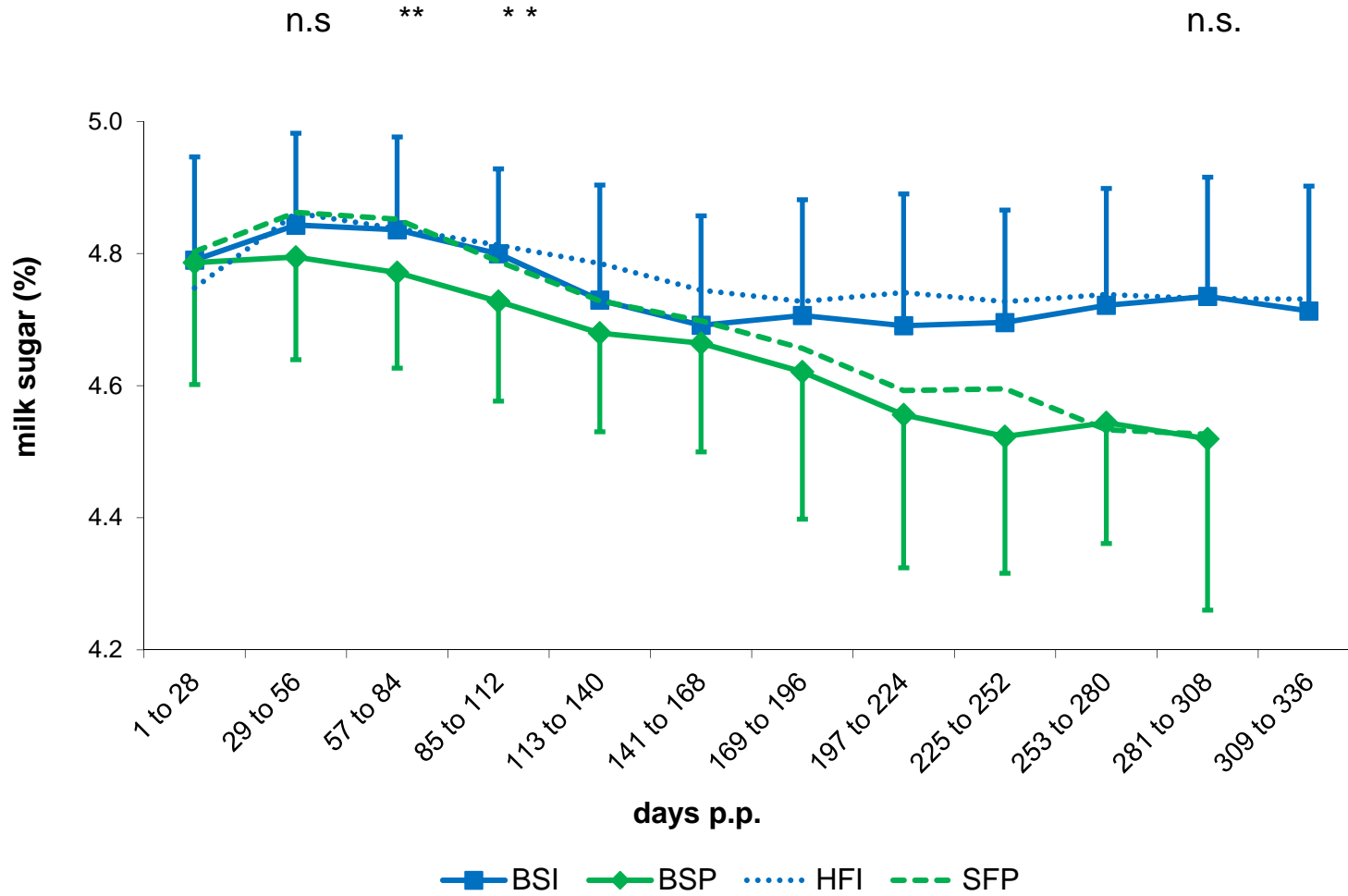
Milk Protein (% , mean and \pm SD)



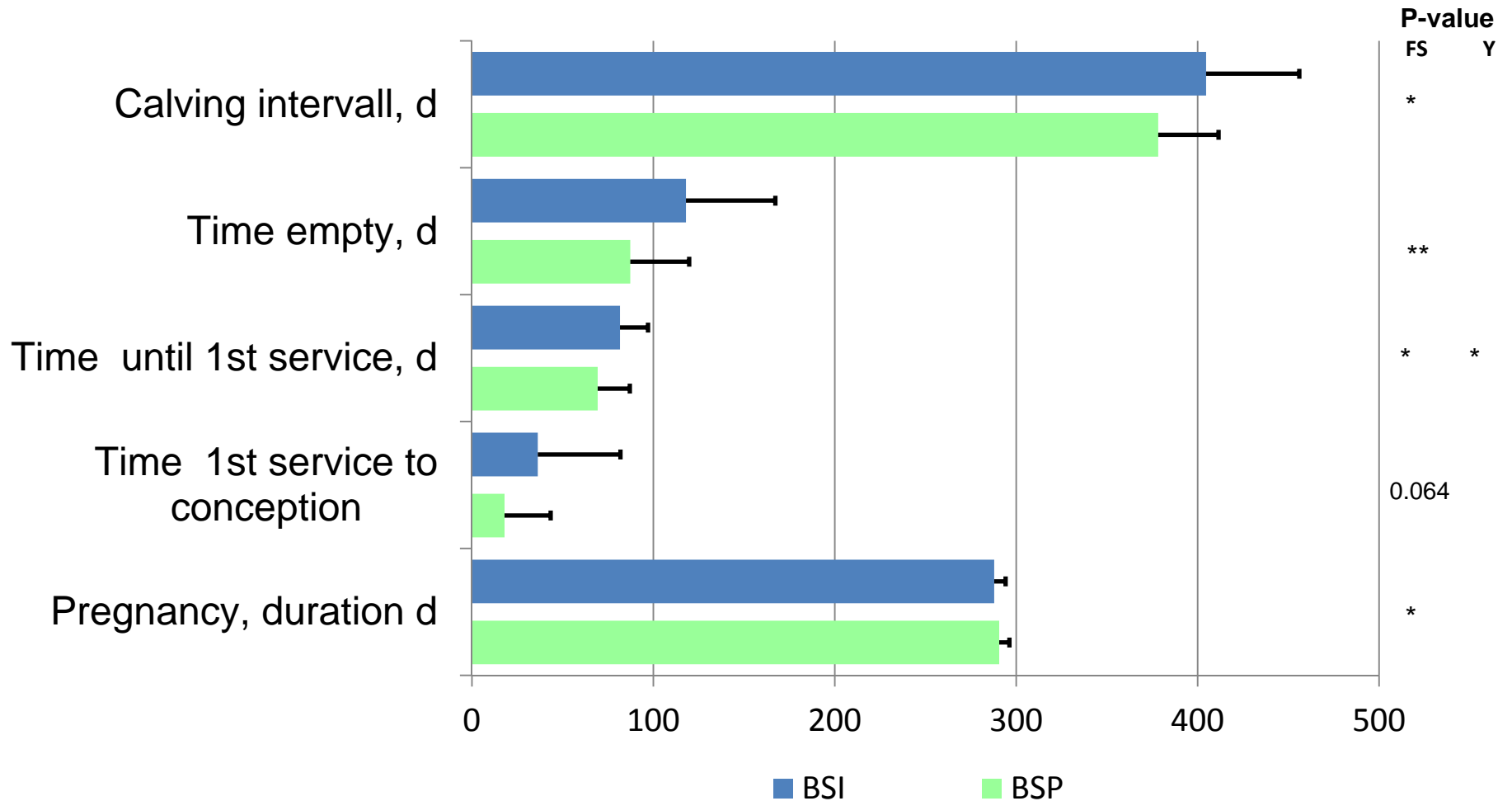
Milk Urea (mg dl⁻¹, mean and ±SD)



Lactose (% , mean and \pm SD)

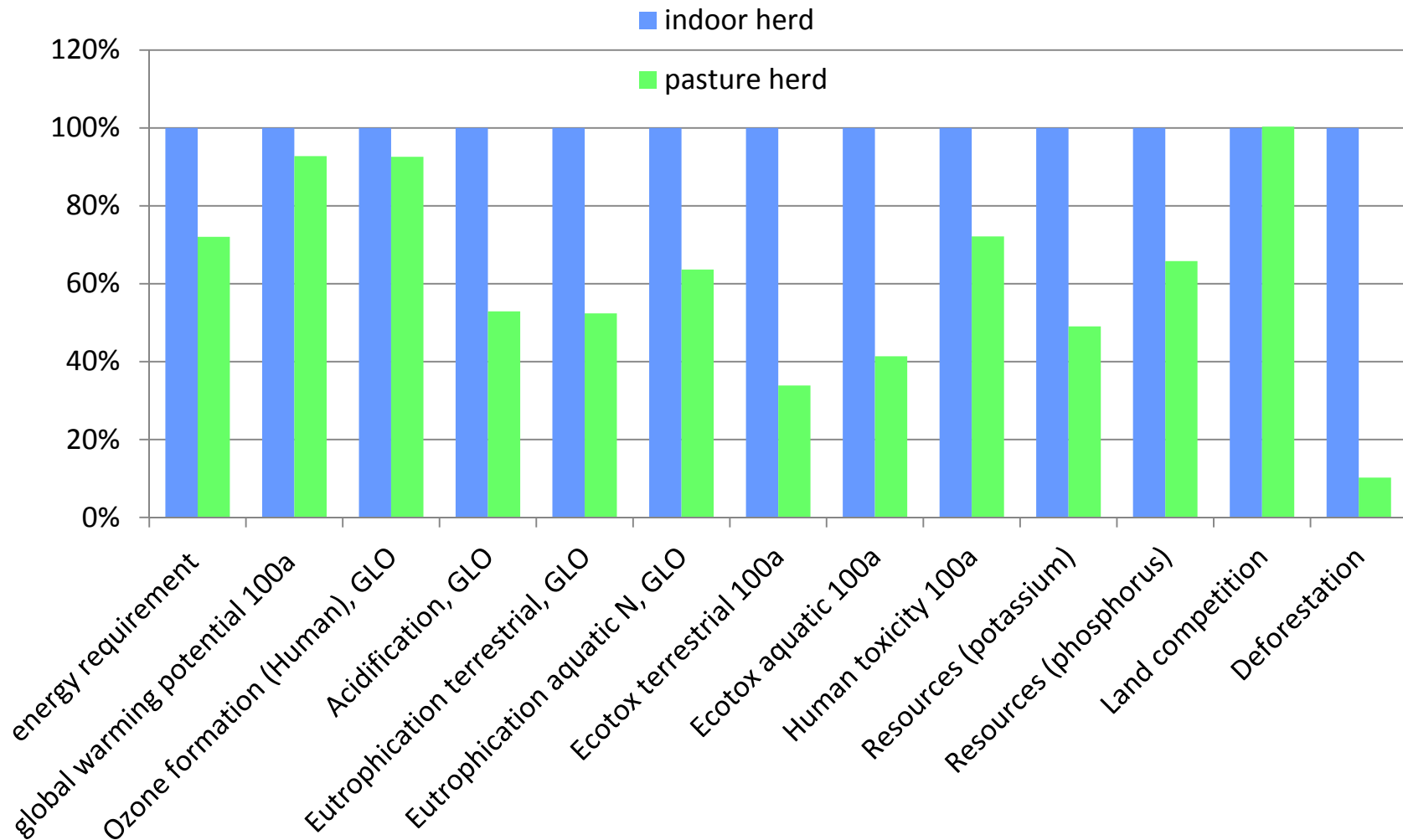


Fertility Data [mean and (SD)]



Number of services per conception: BSI: 1.9 ± 0.2 vs. BSP 1.8 ± 0.2 ; n.s.
 HFI 2.3 ± 0.3 , SFP 1.5 ± 0.1

Overview of environmental impacts per ha of agricultural land



source: M. Sutter (2011)

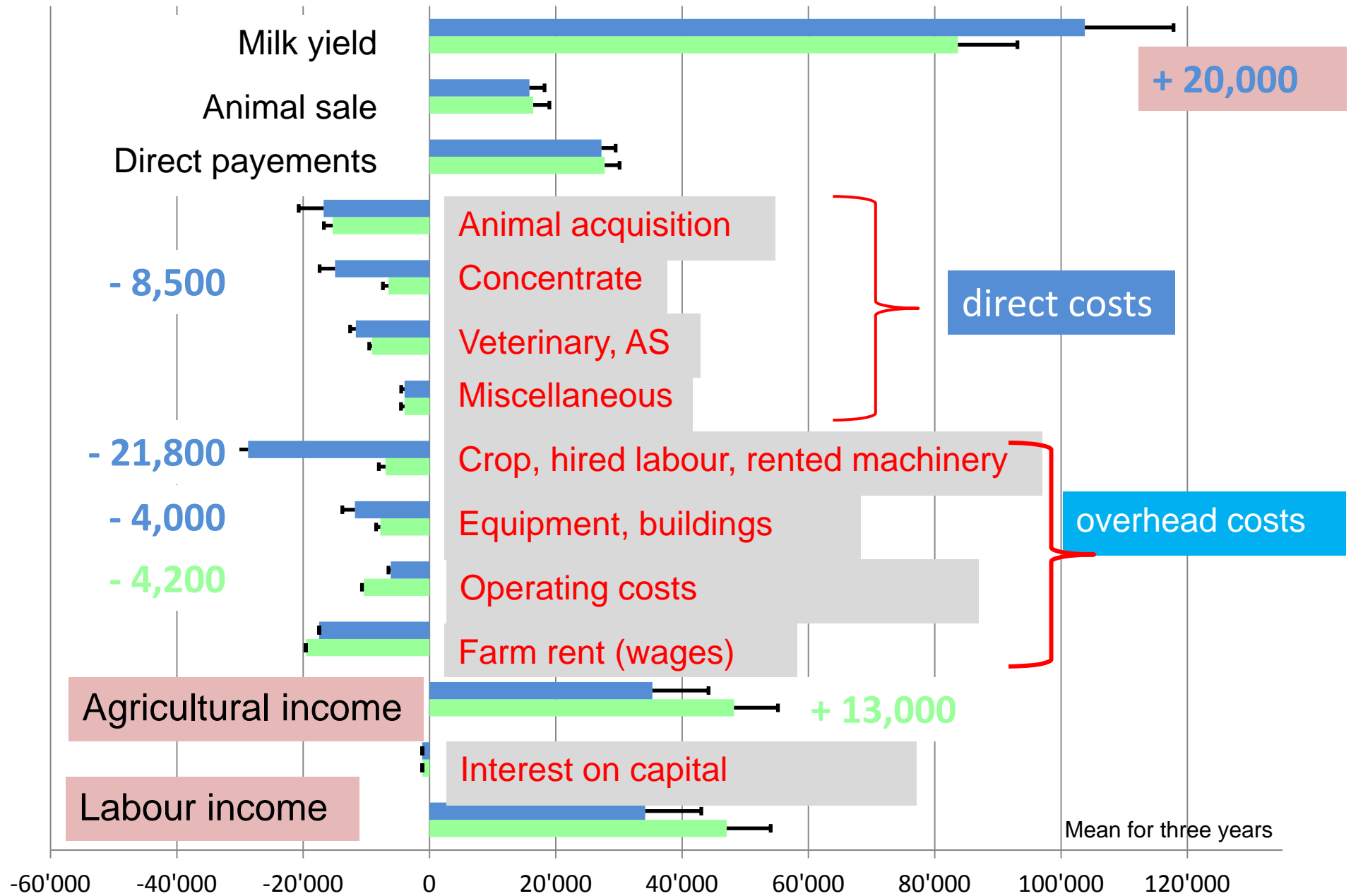
Productivity and Efficiency [mean and (SD)]

2008 – 2010	n	Indoor feeding herd		Pasture-based feeding herd	
		mean	±SD	mean	±SD
ECM (kg (ha AA) ⁻¹ . ¹)	3	12,716	201.3	10,307	616.5
ECM from basic ration (kg (ha AA) ⁻¹)	3	8,810	254.2	9,032	781.0
NEL ³ in DM (MJ kg ⁻¹)	3	6.6	0.02	6.1	0.10
ECM TDMI ⁻¹ . ⁴ (kg kg ⁻¹) i.e. feed efficiency	3	1.3	0.04	1.1	0.03
ECM (kg (kg BW ^{0.75}) ⁻¹)	3	61	1.9	47	0.7

¹ Agriculture Area (i.e. producing area), ² n = measurement y⁻¹, ³ Net energy for lactation, ⁴ Total dry matter intake per cow

⁵ Currency conversion on 27 April 2012: 1 CHF = 0.8324 EUR

Economic Results (mean and \pm SD) (EUR y^{-1})



productivity and income (mean and \pm SD)

Parameters	n	IF-herd		PF-herd	
		mean	\pm SD	mean	\pm SD
Total manpower requirement ¹ (h year ⁻¹)		2,553		2,268	
Produced milk (kg year ⁻¹ herd ⁻¹)	3	194,000	4,990	165,000	4,249
Labour productivity per labour unit hour (kg milk h ⁻¹)	3	76	2.0	73	1.9
Labour income per labour unit hour (EUR h ⁻¹)	3	13.4	3.5	20.7	3.7

¹Total manpower requirement is based on measurements and standard data and mean for three years

Take home messages: indoor fed cows

- Balanced indoor feeding with high quality forages and concentrates has positive effects on milk yield and composition:
grass and corn silage ad lib and 1 ton of concentrates: 9500 kg per lactation
- Successful indoor milk production is characterized by low direct costs and by the distribution of the high fixed costs on as much milk as possible

Take home messages: pasture based milk production

- Milk yield of cows receiving only grass on pasture is limited to 6000 kg per lactation
- Turn out, grass feeding and low feeding intensity of cows on pasture causes better animal health and fertility
- Compared to indoor milk production pasture based production performs better in reference to the ecological balance
- Under the restrictions of growth the potential of cost reduction can faster and with less risk be implemented in a milk production system based on pasture



Thank you for your attention!