



Feed, nitrogen and phosphorus-use efficiency in organic and conventional dairy farming systems in The Netherlands

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Background

Conventional and Organic



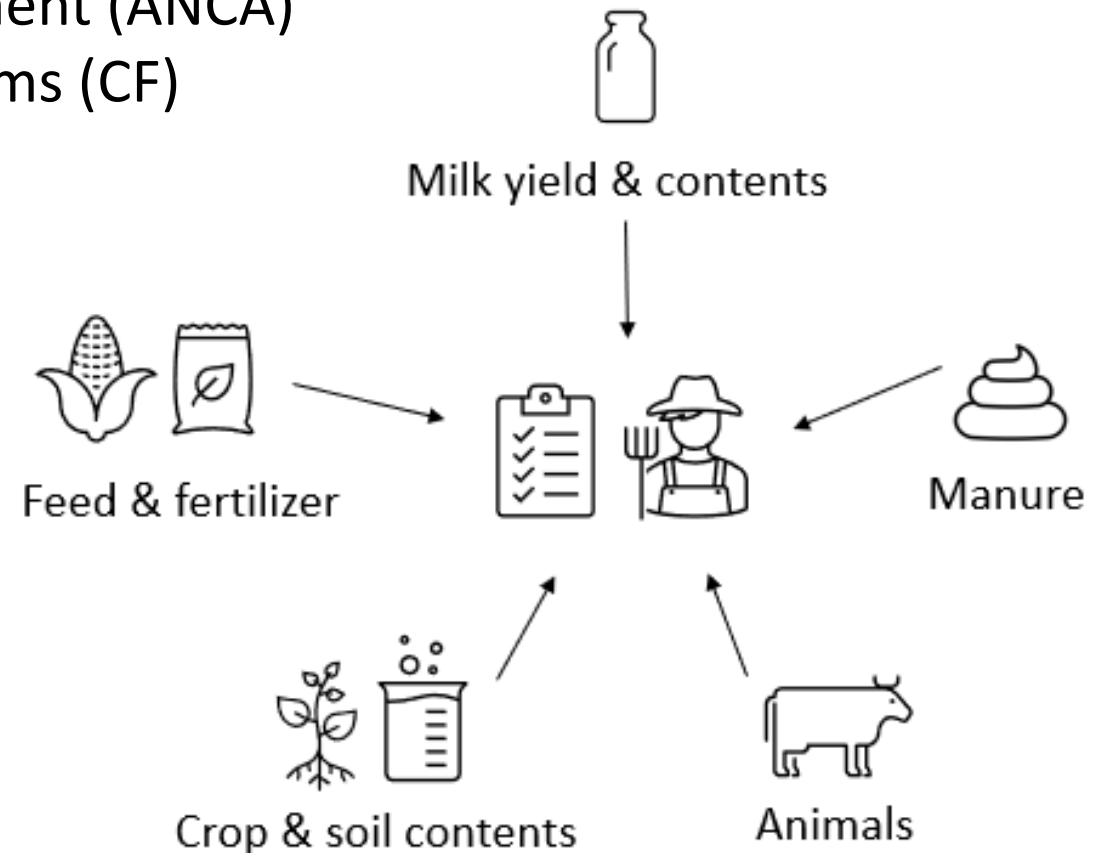
Objective

Compare feed efficiency (FE), nitrogen-use efficiency (NUE) and phosphorus-use efficiency (PUE) of organic (OF) and conventional dairy farms (CF) in The Netherlands

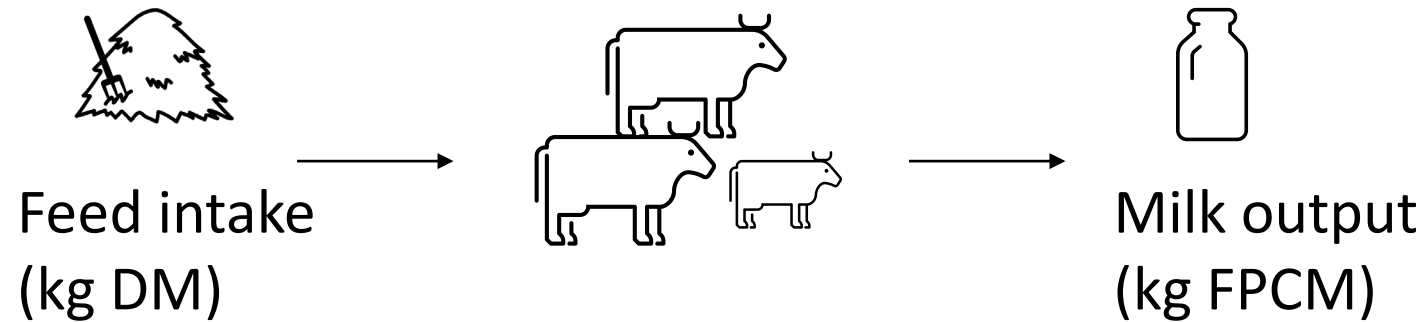
Material & Methods

- Model: Annual Nutrient Cycling Assessment (ANCA)
- 139 organic (OF) & 957 conventional farms (CF)
- 2016 – 2021

Model inputs:



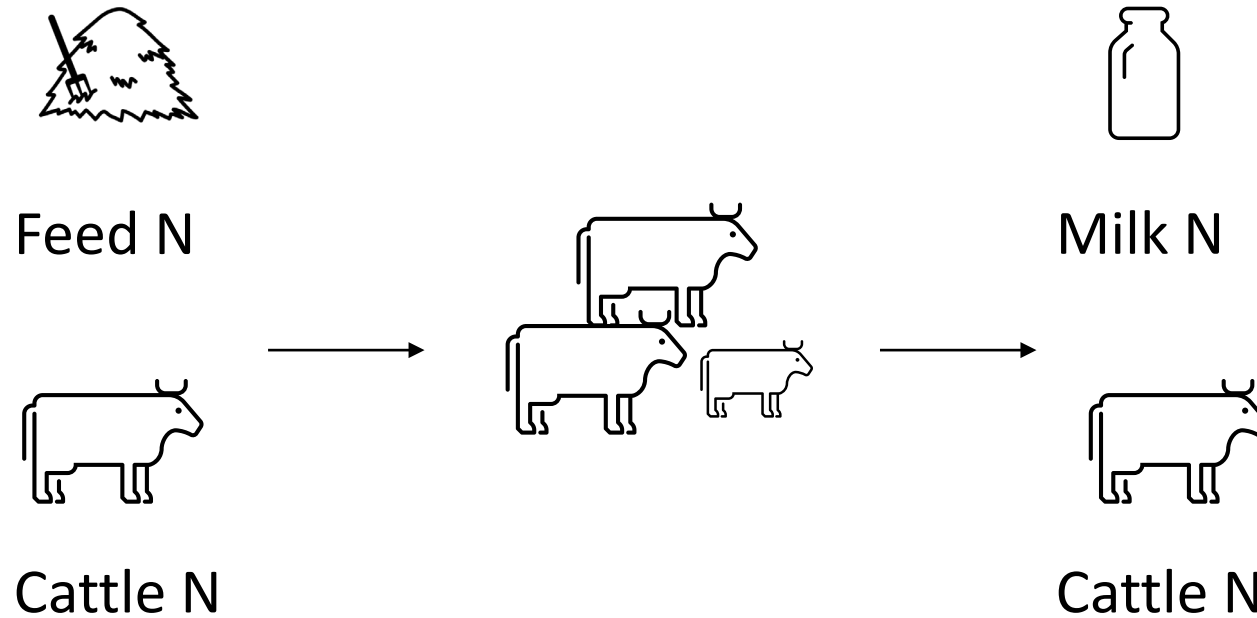
Feed efficiency



FPCM= Fat-Protein Corrected Milk

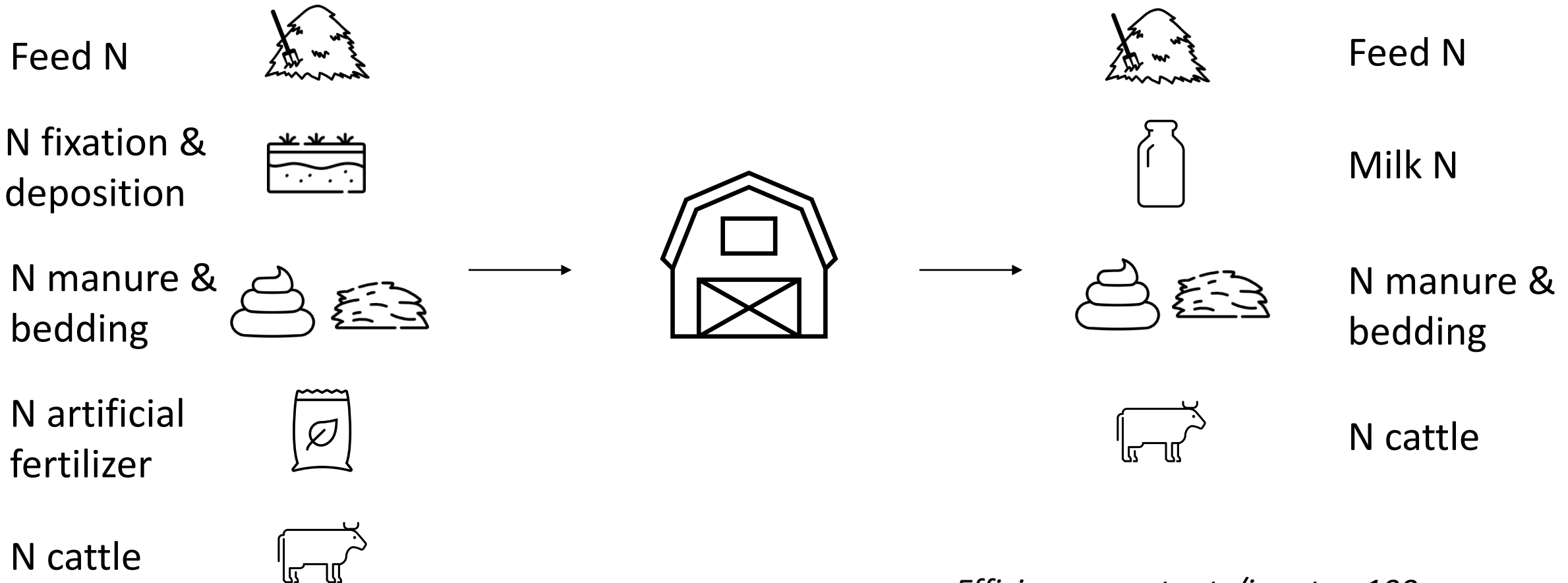
Efficiency = outputs/inputs x 100

N- (and P) use efficiency on herd level



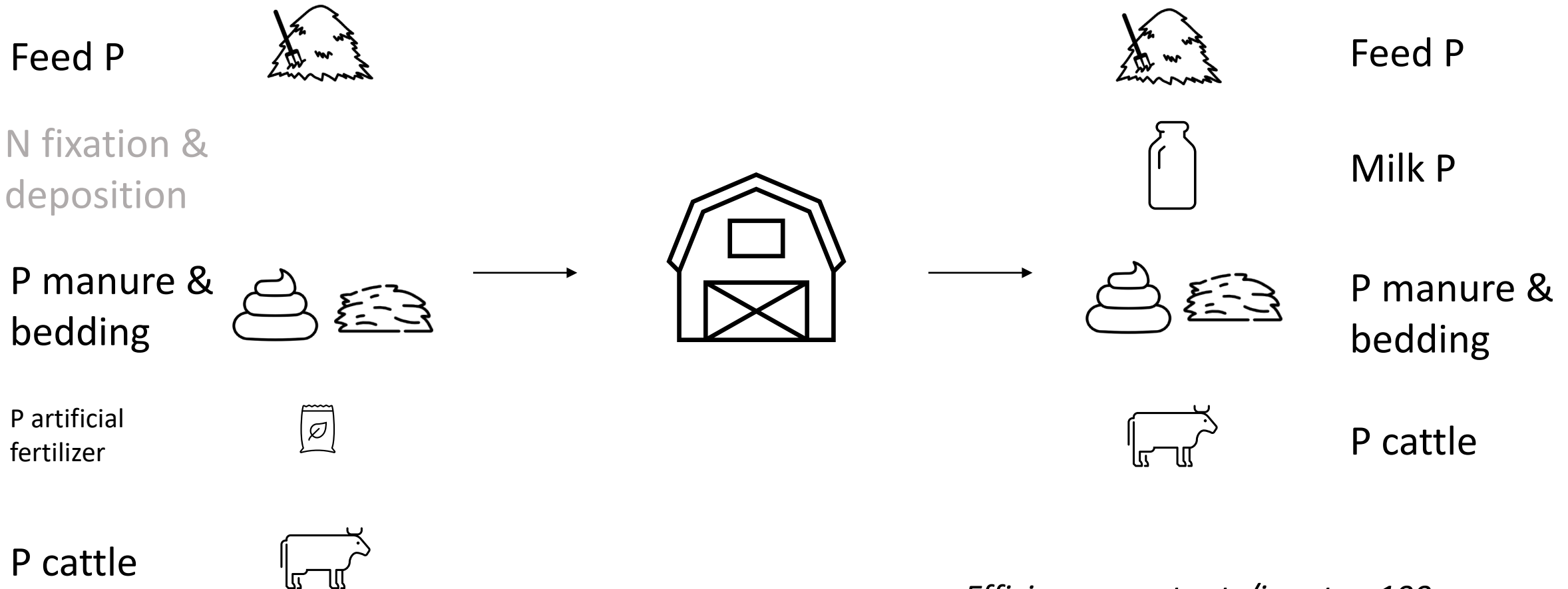
$$\text{Efficiency} = \text{outputs/inputs} \times 100$$

N- (and P) use efficiency on farm level



$$\text{Efficiency} = \text{outputs/inputs} \times 100$$

N- (and P) use efficiency on farm level



$$\text{Efficiency} = \text{outputs}/\text{inputs} \times 100$$

Statistical analysis

- Response variables:
 - General farm characteristics
 - FE, NUE, PUE
- Fixed effects: organic (yes/no), year (2016-2021), soil type (sand, clay, peat, mix), all 2-way interactions
- Repeated: farm

Farm characteristics

Variable	Unit	Farm type (least squares means)*		
		Conventional	Organic	Pooled SEM
Number of cows	#	113	95	2.6
Youngstock per 10 cows	#	5.5	5.9	0.08
Surface land	ha	59	75	1.4
Days of grazing	#	115	195	2.6
Milk per cow	kg/year	8969	7346	40.1
Milk per ha	tons	18.1	9.8	0.28
Milk fat	g/kg	44.0	42.8	0.06
Milk protein	g/kg	35.5	35.0	0.04
Milk urea	mg/100 g	22.0	20.2	0.07

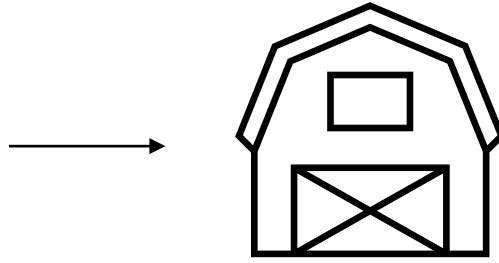
* $P < 0.05$

Ration characteristics

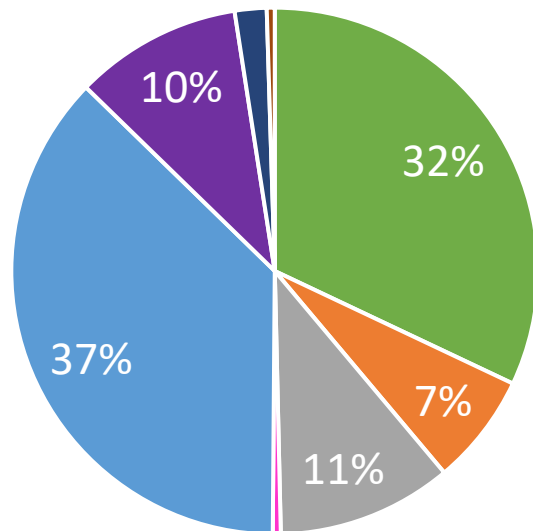
Variable	Unit	Farm type (least squares means)*		
		Conventional	Organic	Pooled SEM
Grass silage	% DM	41.0	45.1	0.32
Maize silage	% DM	17.0	5.7	0.38
Concentrates and milk powder	% DM	27.3	22.4	0.19
Fresh grass	% DM	9.5	24.3	0.29
Concentrates per 100 kg milk	kg	28.0	26.5	0.18
P-content	g/kg DM	3.58	3.72	0.009
N-content	g/kg DM	26.6	24.8	0.05
NE-content	MJ/kg DM	6.73	6.46	0.006

* $P < 0.05$

N input

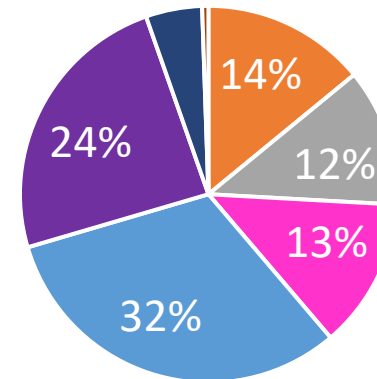


Conventional farms



Total N input: 409 kg/ha

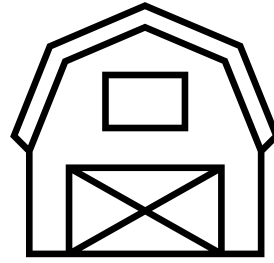
Organic farms



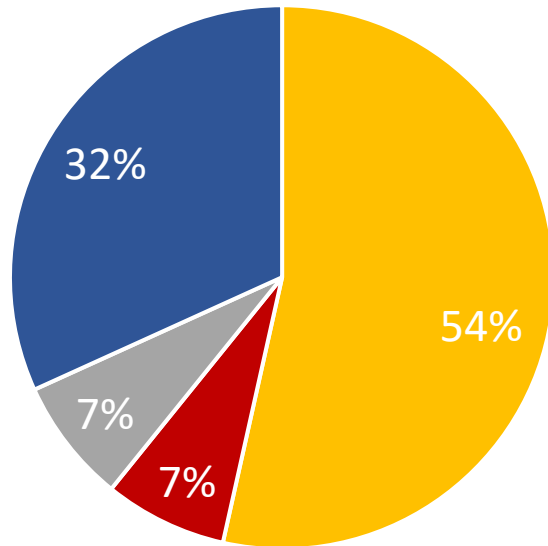
Total N input: 187 kg/ha



N output

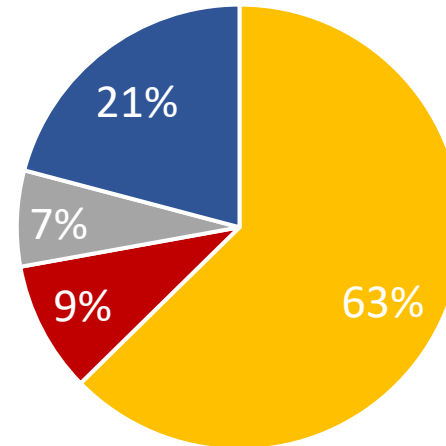


Conventional farms



Total N output: 189 kg/ha

Organic farms



Total N output: 86 kg/ha

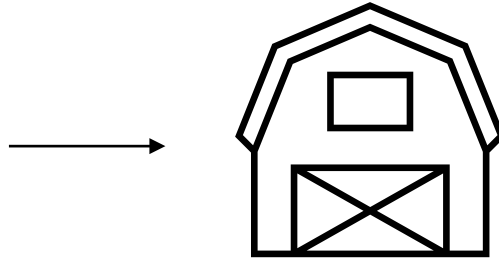
 Milk

 Livestock

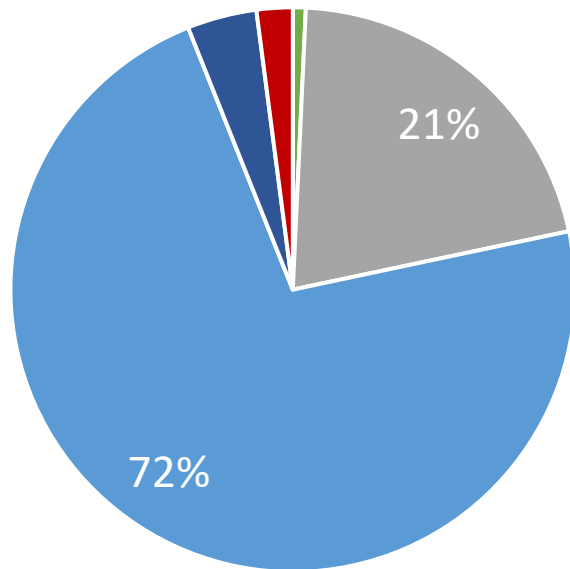
 Roughage

 Manure & bedding material

P input

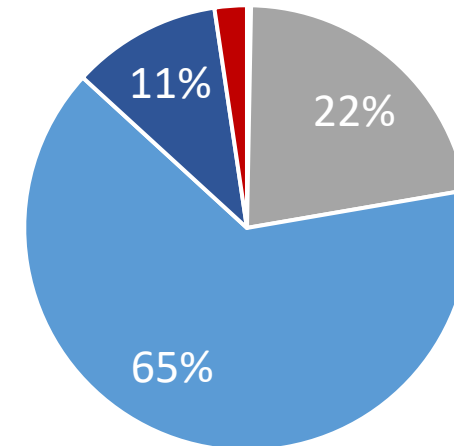


Conventional farms



Total P input: 68 kg/ha

Organic farms



Total P input: 34 kg/ha

 Concentrates

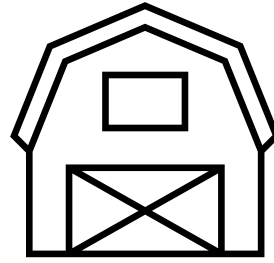
 Roughage and by-products

 Manure & bedding material

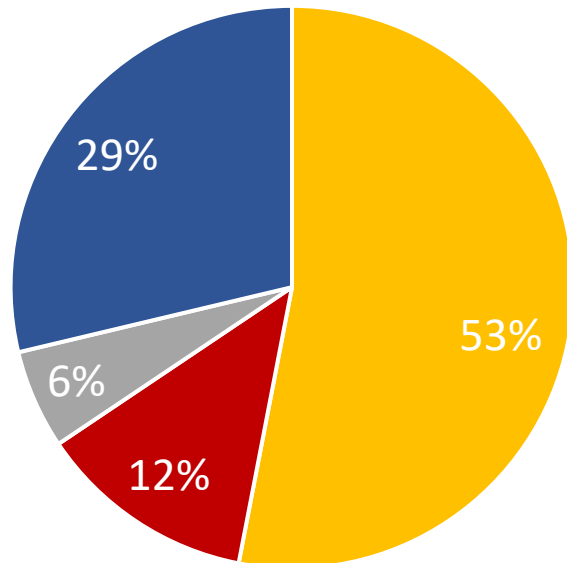
 Artificial fertilizer

 Livestock

P output

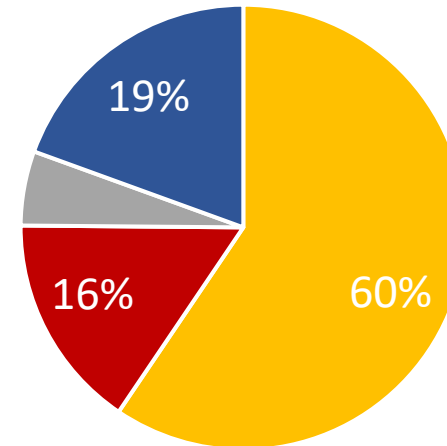


Conventional farms



Total P output: 77 kg/ha

Organic farms



Total P output: 37 kg/ha

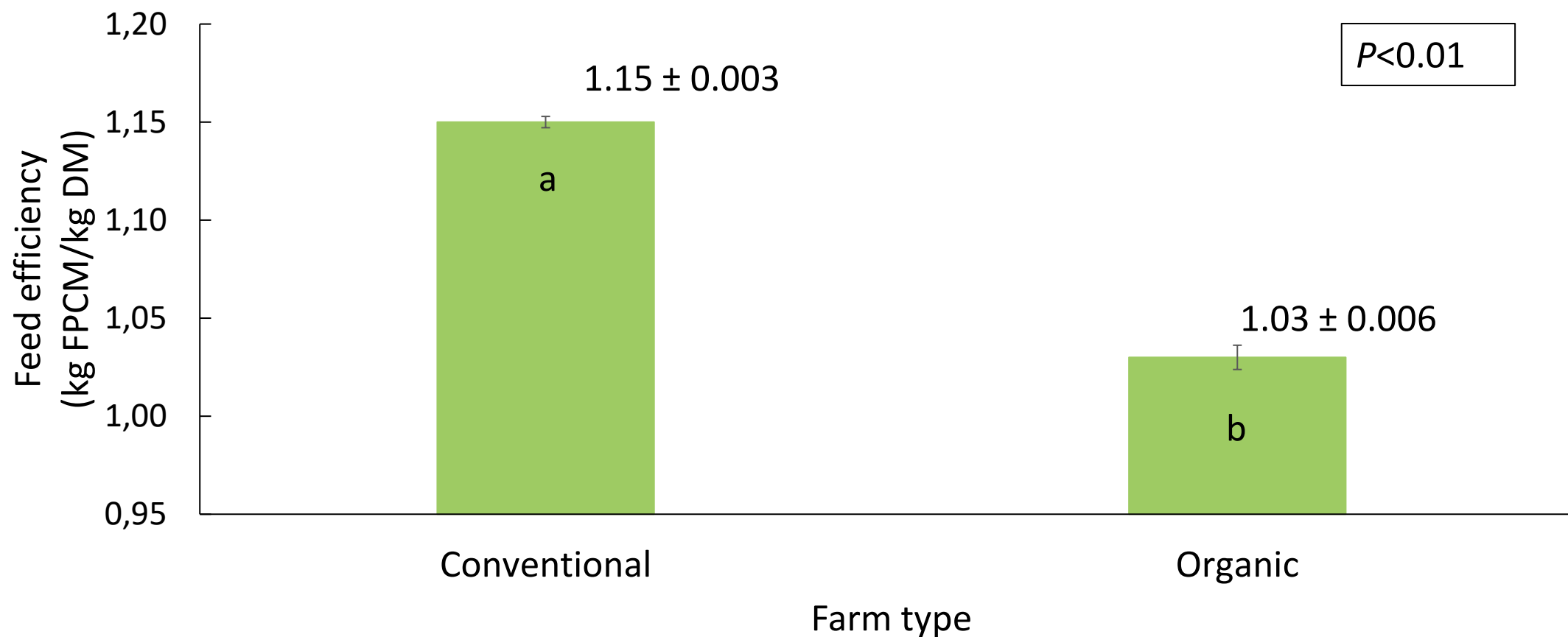
 Milk

 Livestock

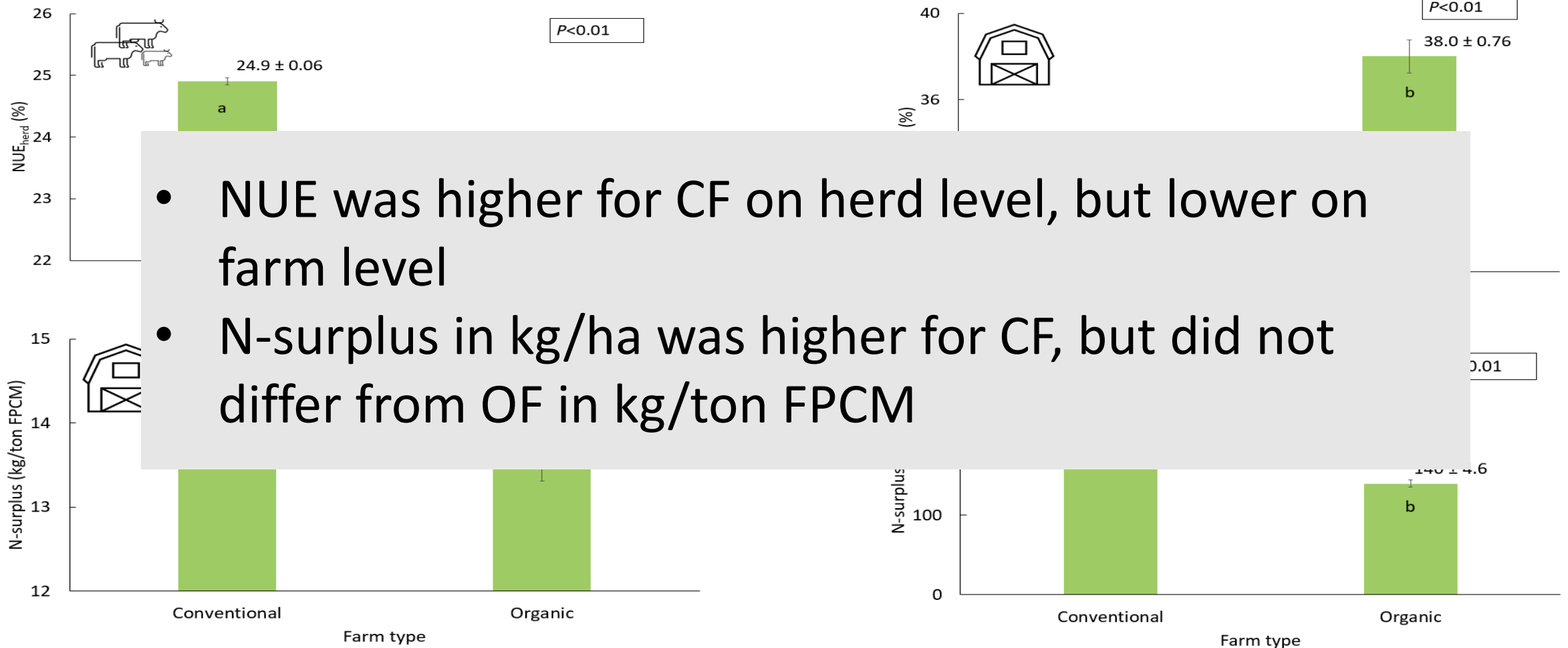
 Roughage

 Manure & bedding material

Feed efficiency

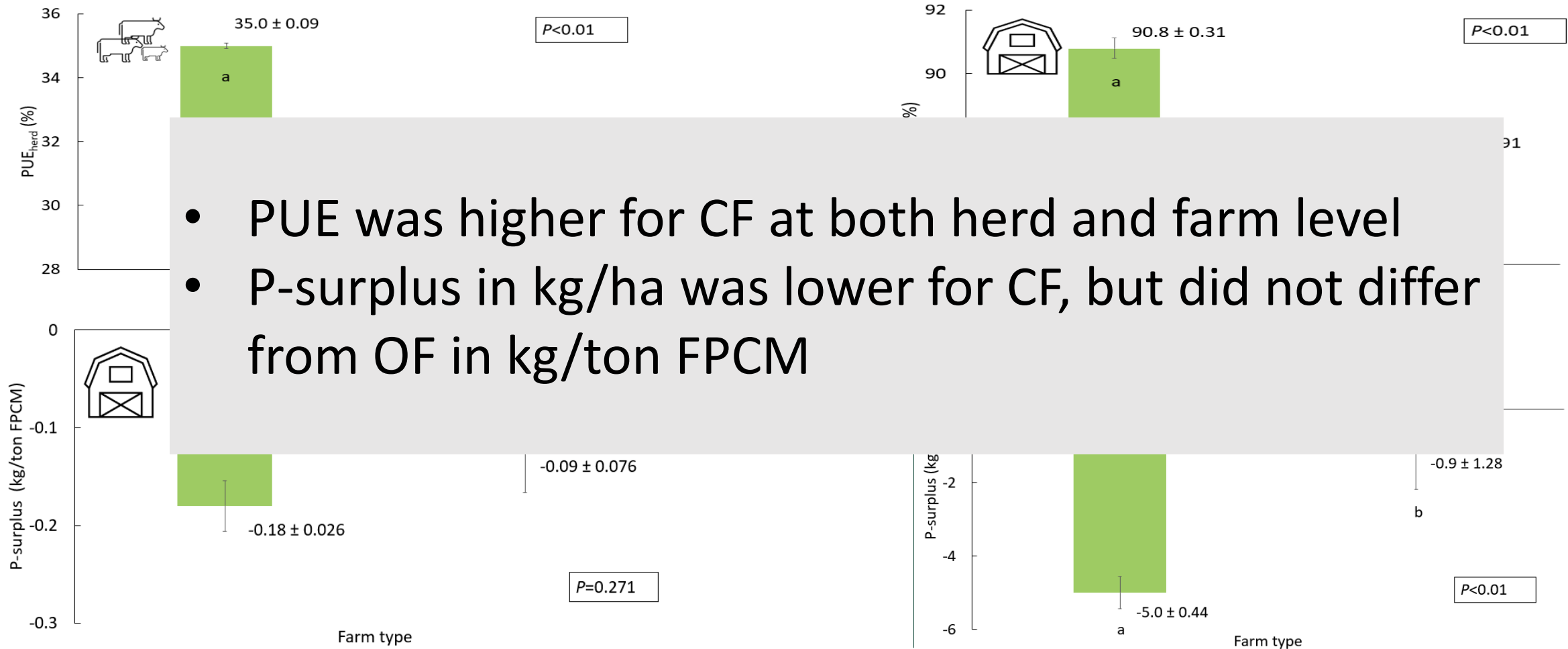


N use-efficiency



NUE=Nitrogen use efficiency, CF=conventional farms, OF=organic farms

P use-efficiency



PUE=Phosphorus use efficiency, CF=conventional farms, OF=organic farms

Conclusions

- P-use efficiency: higher for conventional farms, regardless of unit
- N-use efficiency: difference between organic and conventional farms depending on unit
- Further comparative analysis of dairy systems could help us to identify potential strategies that decrease N and P losses to the environment

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