



UNIVERSITÀ DEGLI STUDI DI MILANO
DIPARTIMENTO DI SCIENZE AGRARIE
E AMBIENTALI - PRODUZIONE,
TERRITORIO, AGROENERGIA



Effect of feed ingredient based on processed former foodstuff in dairy cow diet: performance and environmental impact

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MINISTERO DELL'AGRICOLTURA
DELLA SOVRANITÀ ALIMENTARE
E DELLE FORESTE



THE ISSUE:

At the EU level it is well known the «deficit» in protein feed locally produced for animal nutrition.

However:

also for the energy feed (cereals i.e. corn):

decrease in the national production over the course of years
increase of import (both from EU and no EU countries)

THE CASE OF CORN GRAIN USE IN ITALY

	National Production (t)	Imported (t)	Exported (t)	Total availability
Corn 2022	4.717.454,00	6.910.114,00	47.817,00	11.579.751,00
Corn 2000	10.137.502,00	476.598,00	180.622,00	10.433.478,00
2022 vs. 2000 (% variation)	-53			11

Source: ASSALZOO



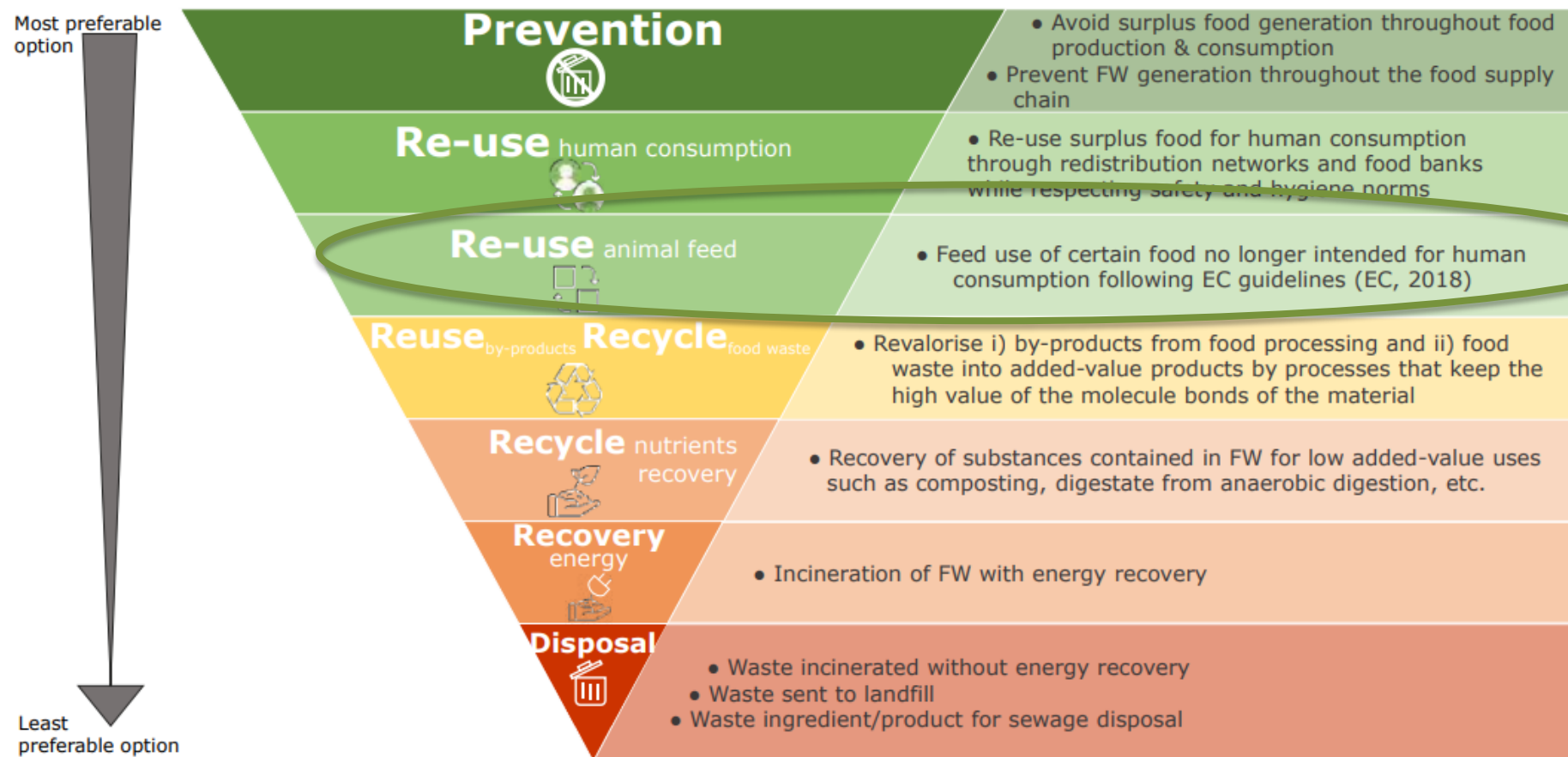
■ National production
■ Imported from other countries

2022



■ National production
■ Imported from other countries

2000



Fonte: https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement_en

THE AIM

Evaluate on lactating cows the effects on: milk production, digestibility and environmental impact of a circular diet with processed former foodstuff (FF) in total replacement of corn meal



MATERIAL AND METHODS

- A change-over design on 34 Italian Holstein cows;
- 3 weeks of diet adaptation and 1 week of sample collection;
- individual milk production (by AMS system) was recorded and individual samples were analysed;
- feces and urine samples were collected in 2 days for each sample collecting period;
- urine samples analysed for creatinine and N content;
- chewing activity (rumination and feeding) was registered (Moomonitor)
- uNDF used as internal marker to estimate digestibility;
- environmental impact of the diets was estimated with LCA assessment (Simapro software).

DIETS INGREDIENT COMPOSITION

Ingredient (% DM)	C	FF
High moisture corn	18.2	18.2
Corn silage	17.7	17.8
Soybean Silage	12.8	12.9
Hay	10.6	10.6
Corn meal	11.8	-
Former foodstuff	-	15.2
Solvent soybean meal	9.8	9.8
AMS compound feed	12.7	12.7
Sugar cane	3.6	-

C= control diet; FF= Former food diet
AMS= automatic milking system

CORN MEAL VS. FF

Corn meal	%DM	FF
68.8	Starch	39.0
8.80	Crude protein	10.8
4.10	EE	10.0
2.00	Soluble sugar	19.0
1.08	UFL	1.16

DIETS CHEMICAL COMPOSITION (% on DM)

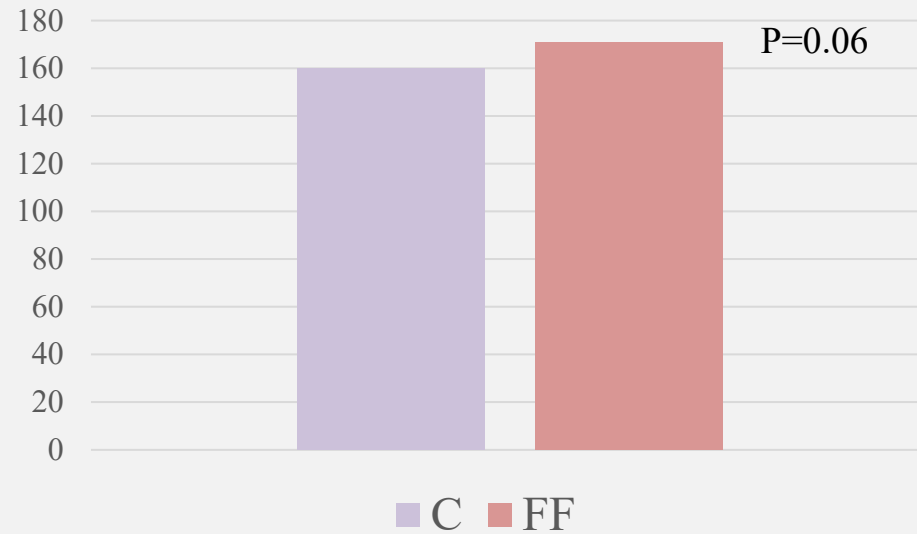
	C	FF
DM %	58.4	58.3
CP	14.3	15.4
Ash	6.87	6.79
EE	3.16	4.50
NDF	33.4	32.8
ADF	21.6	21.5
ADL	5.34	5.05
Starch	27.9	24.7
Soluble sugar	6.50	7.10
ME (Mcal/kg)	2.47	2.52

MILK PRODUCTION

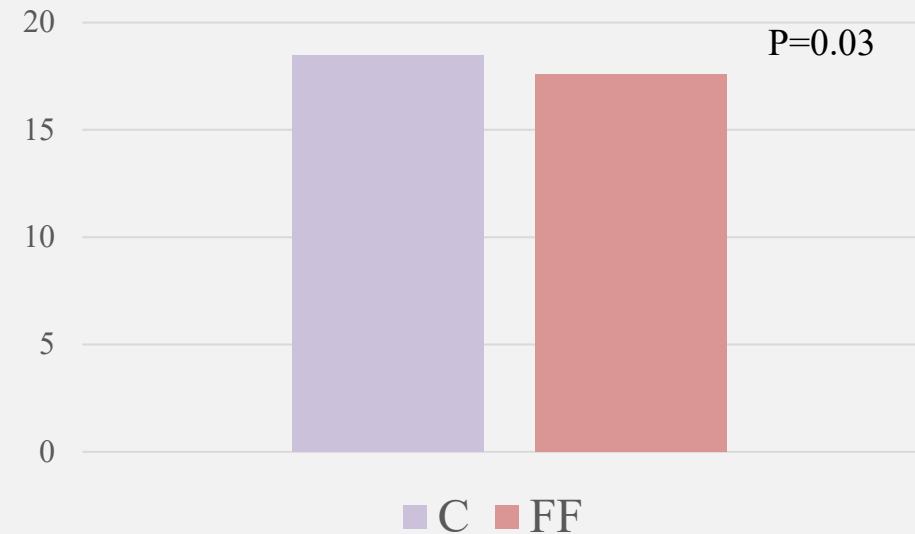
		C	FF	SE	P
est. DMI	kg/d	25.6	25.8	0.355	0.341
Compound feed intake at milking	kg/d	3.47	3.74	0.135	<0.001
Milk production	kg/d	39.0	39.5	1.09	0.389
FPCM	kg/d	36.0	36.6	1.04	0.53
Fat	%	3.45	3.40	0.108	0.665
Protein	%	3.28	3.29	0.038	0.694
Lactose	%	4.95	4.84	0.028	<0.001
Urea	mg/dL	26.8	29.0	0.647	0.003

URINE VOLUME AND URINARY N EXCRETION

Urinary N excretion (g/d) with the two diets



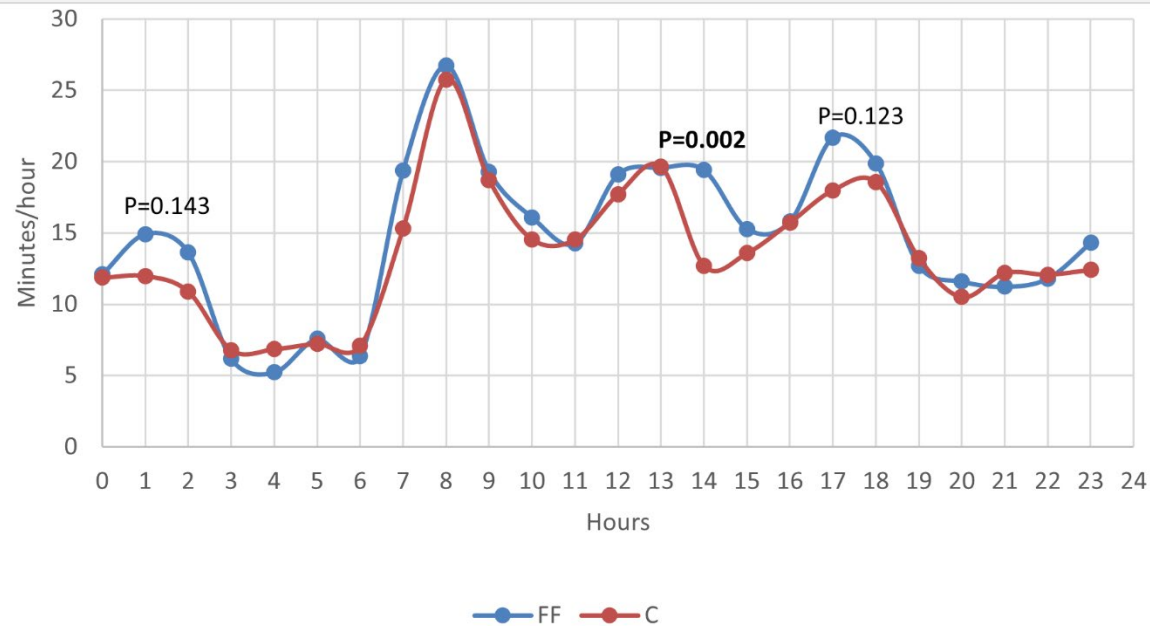
Urine volume (kg/d) with the two diets



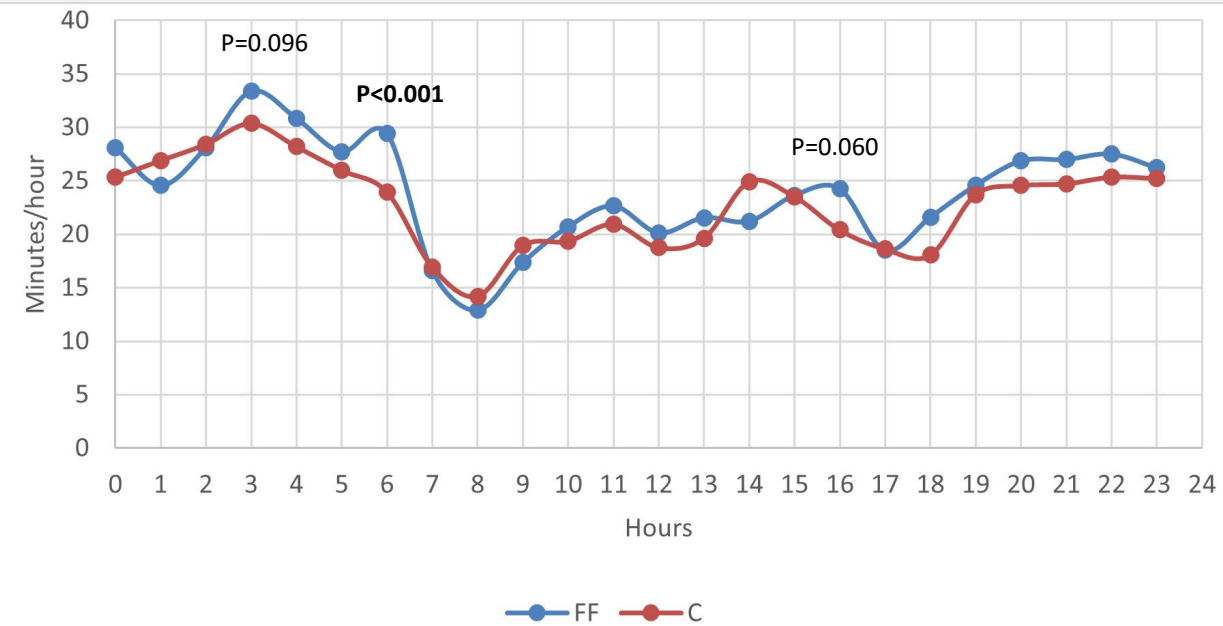
Estimated urinary N excretion= C 25.5% N intake
FF 26.0 % N intake
P=0.632

Feeding and rumination activity (minutes/h) of cows

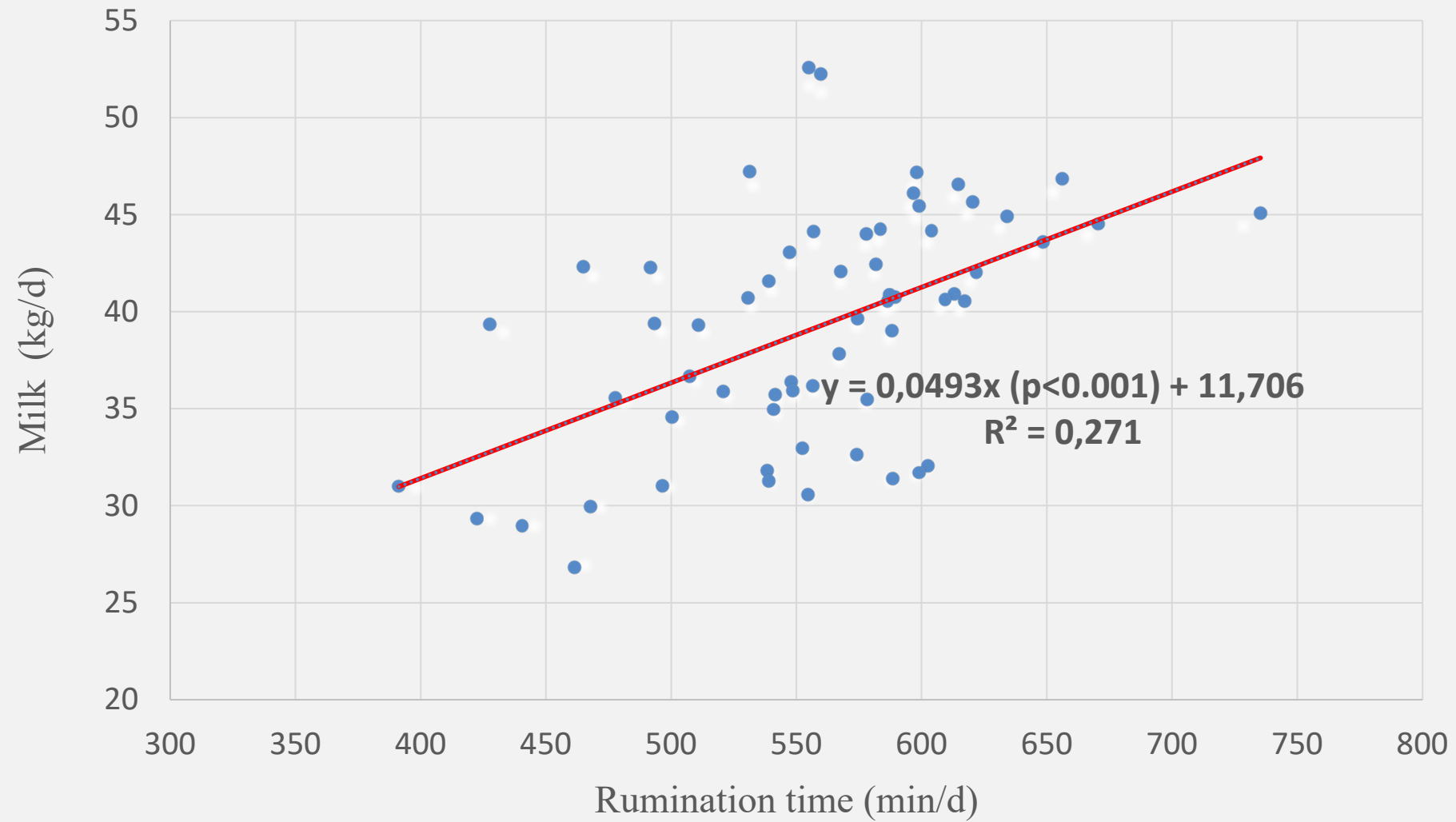
Feeding activity



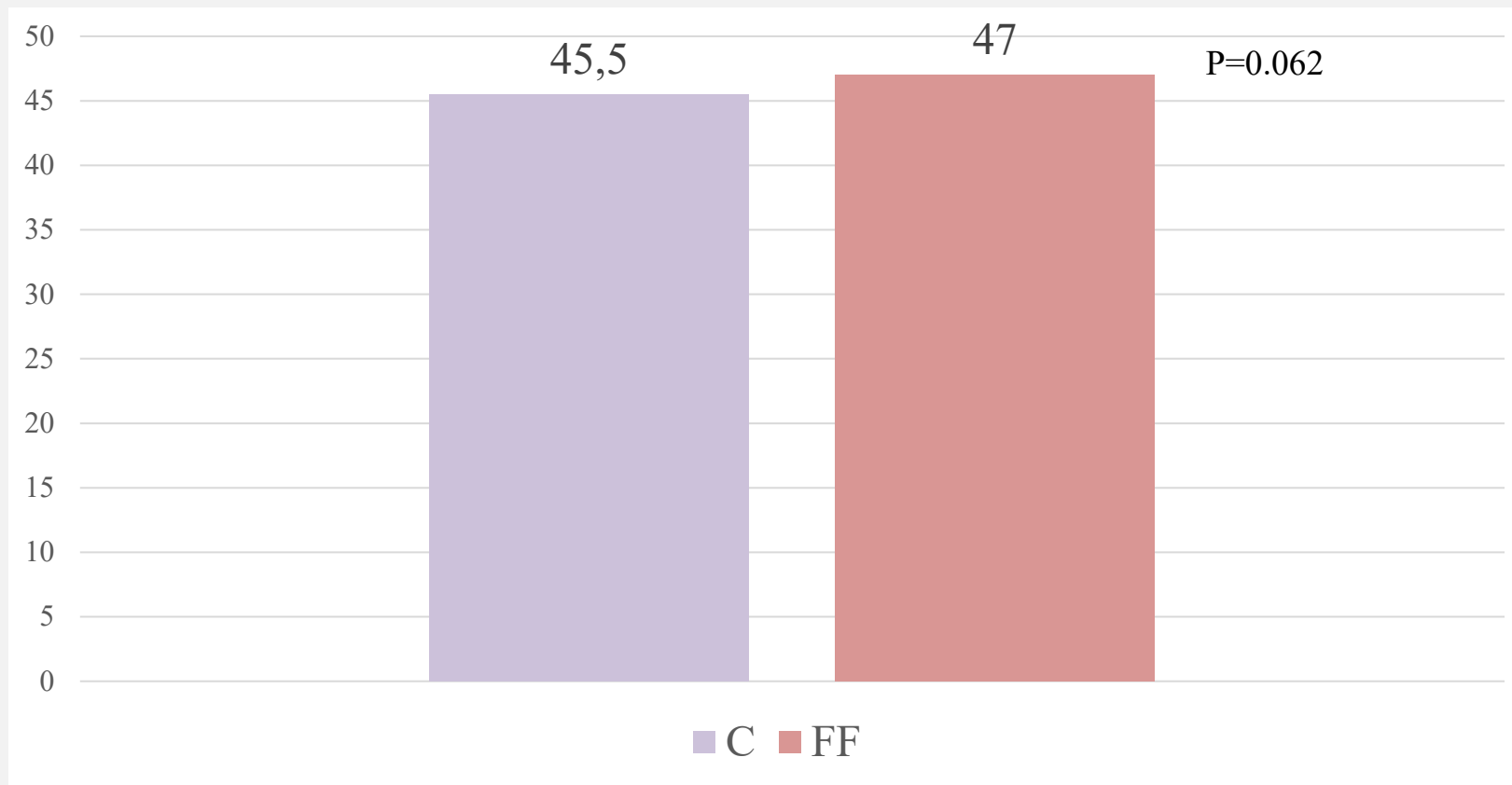
Rumination activity



Rumination time and milk production

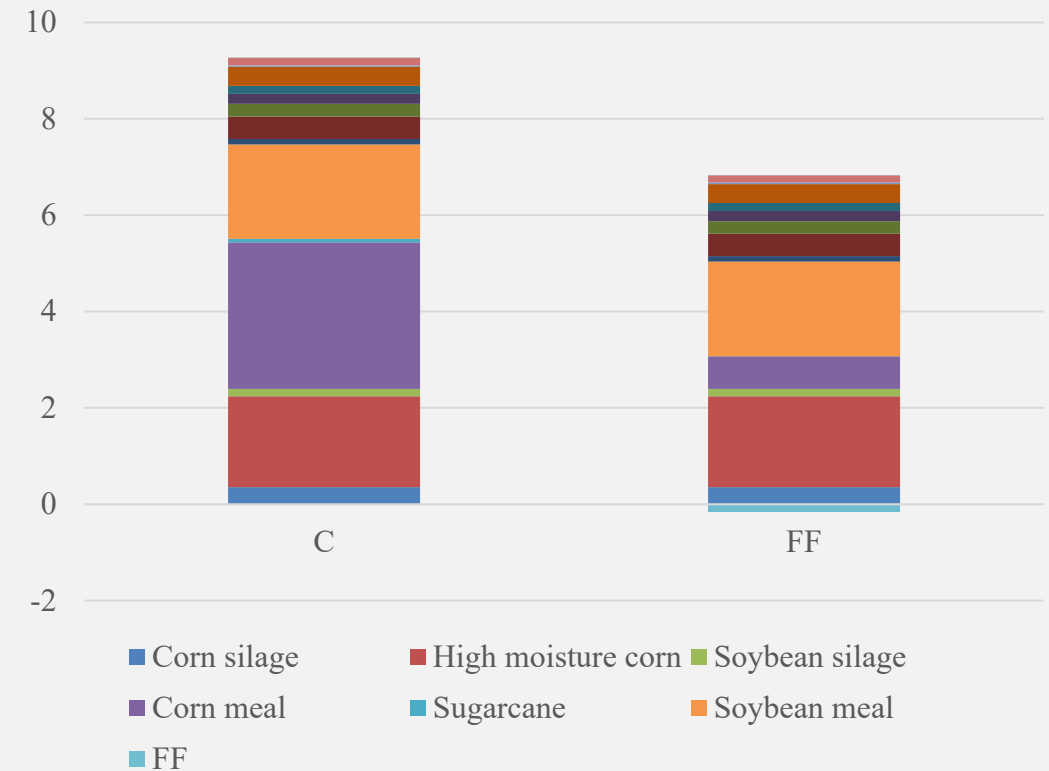


Total tract NDF apparent digestibility (%)



GLOBAL WARMING POTENTIAL OF THE TWO EXPERIMENTAL DIETS (kg CO₂ eq/d)

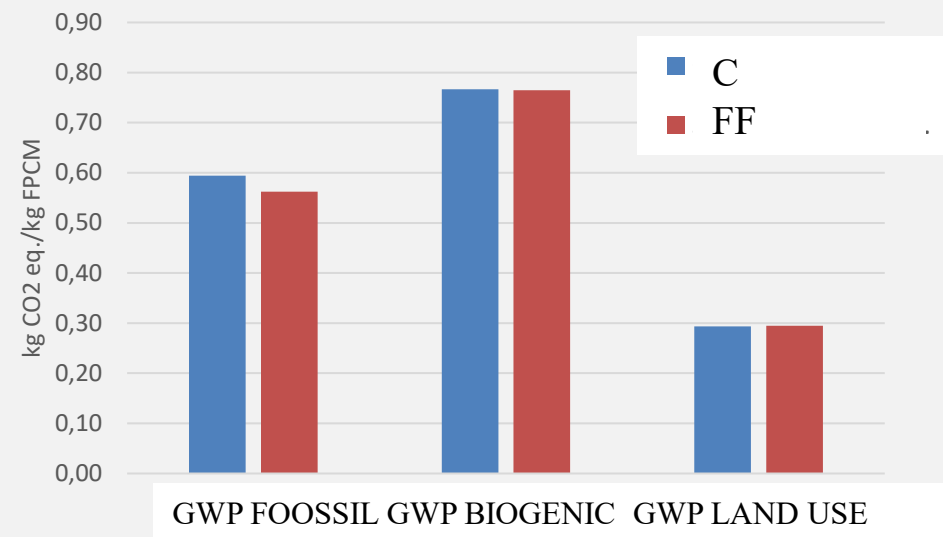
	C	FF
GWP - fossil	9.26	6.68
GWP - biogenic	0.04	0.02
GWP - land transformation	9.54	9.54
GWP - Total	18.9	16.2



GWP fossil due to each feed ingredient

LCA of milk production with the 2 diets

		C	FF
Global warming	kg CO ₂ eq	1.85	1.82
Acidification	kg SO ₂ eq	0.018	0.018
Marine eutrofization	kg N eq	0.002	0.002
Land use	m ² crop eq	1.51	1.48
Water Consumption	m ³	0.391	0.377



Environmental impact from another case study

Ingredient (kg as fed/d)	C	FF
Corn silage	30.0	29.0
Hay	9.00	9.20
High moisture corn	6.30	3.00
Soybean meal	3.13	3.07
Corn meal	1.50	2.20
Former Food		1.80
Alfalfa hay	1.50	
Sunflower meal	1.64	1.61
Sugar cane	1.40	1.30
Wheat Bran	0.83	0.78
Min vit	0.67	0.66
Corn gluten	0.43	

		C	FF
Global warming	kg CO ₂ eq	1.73	1.71
Acidification	kg SO ₂ eq	0.018	0.017
Marine eutrofization	kg N eq	0.002	0.002
Land use	m ² crop eq	0.99	0.97
Water Consumption	m ³	0.554	0.555

CONCLUSION

- The use of former food was, where possible, a valide alternative to corn meal;
- improvement of environmental sustainability of milk production and increasing the circularity of the sector;
- potential issues:
availability on the market
pdo production



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