



A 7-Year Survey on corn silage nutrient composition in Po Valley (Italy)

Abbate Rossella¹, Ottoboni Matteo¹, Luciano Alice¹, Grandi Elisa³, Pinotti Luciano^{1,2}

¹ Department of Veterinary Medicine and Animal Sciences, University of Milan, Lodi, Italy,

² CRC I-WE, University of Milan, 20134 Milano, Italy,

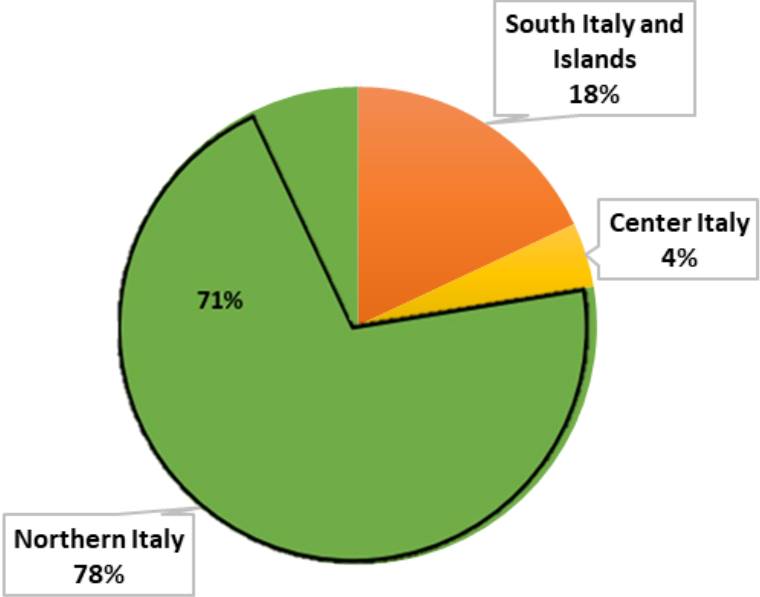
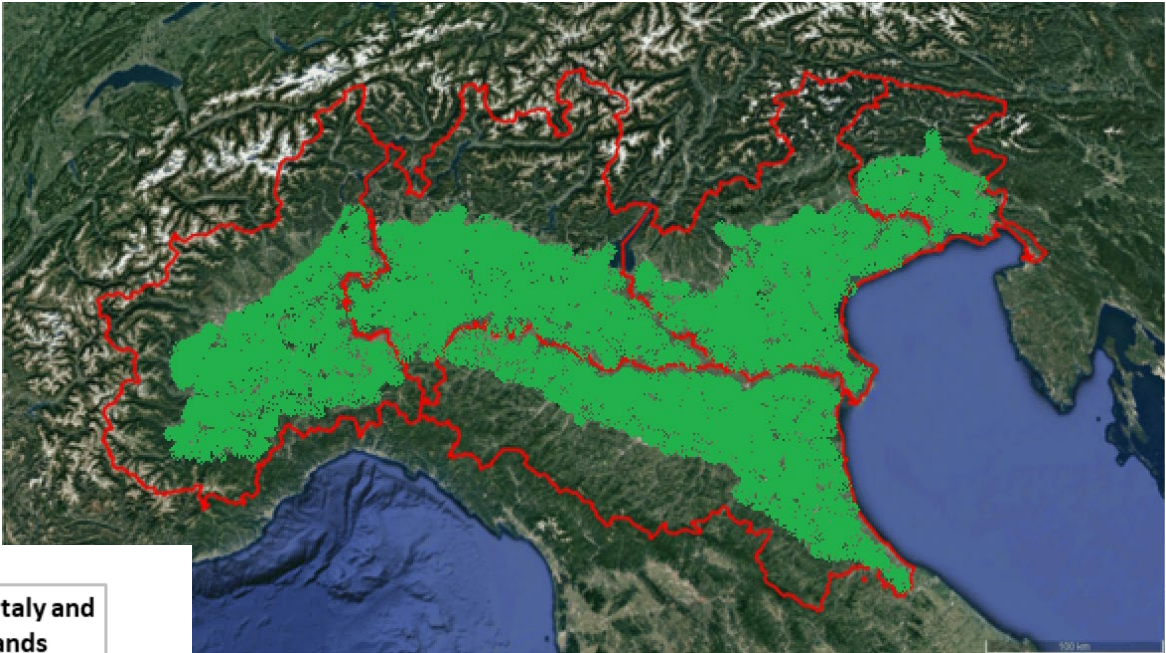
³ Associazione Regionale Allevatori della Lombardia (ARAL), Via Kennedy, 26013 Crema, Italy



Introduction

Region	n. dairy cows (2022)
Lombardy	579,042
Emilia-Romagna	251,677
Veneto	147,847
Piedmont	143,414
Trentino-Alto Adige	89,598
Puglia	69,394
Sicily	56,859
Campania	50,175
Lazio	46,132
Sardinia	46,101
Friuli-Venezia Giulia	33,921
Basilicata	24,216
Calabria	19,881
Valle d'Aosta	17,782
Abruzzo	16,215
Molise	12,037
Tuscany	11,862
Umbria	7,967
Liguria	7,074
Marche	5,934
Total	1631,128

Source: ISTAT



Introduction

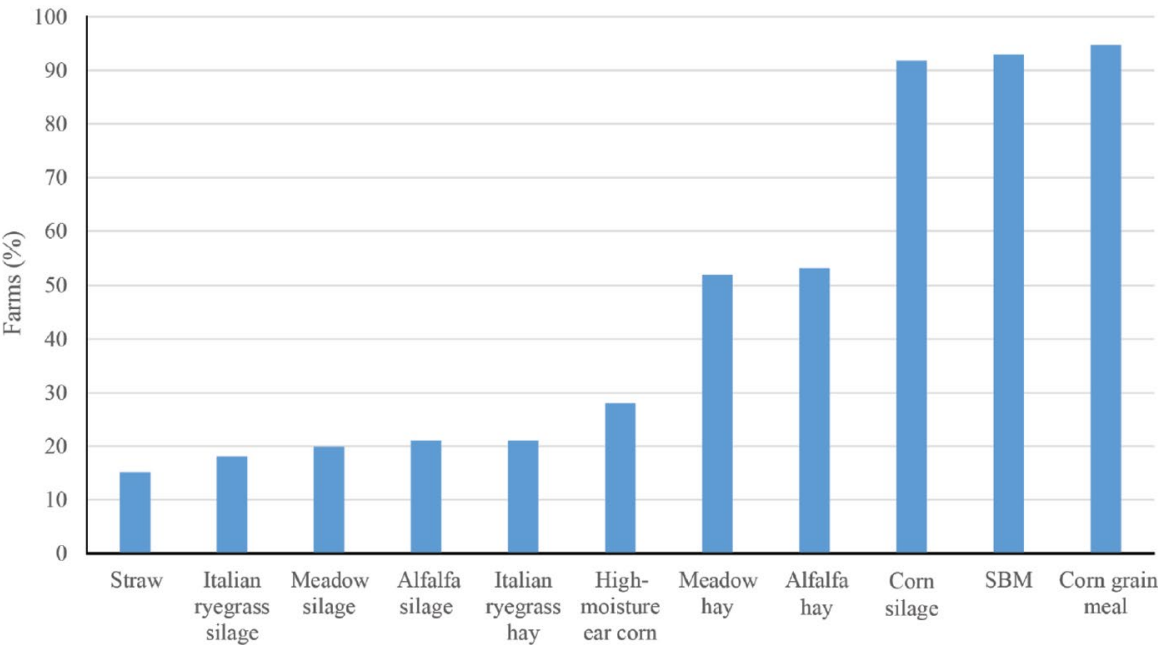
Total Italian Milk Production in 2023 - **12.910.696 (Tons)**



Regione
LOMBARDIA

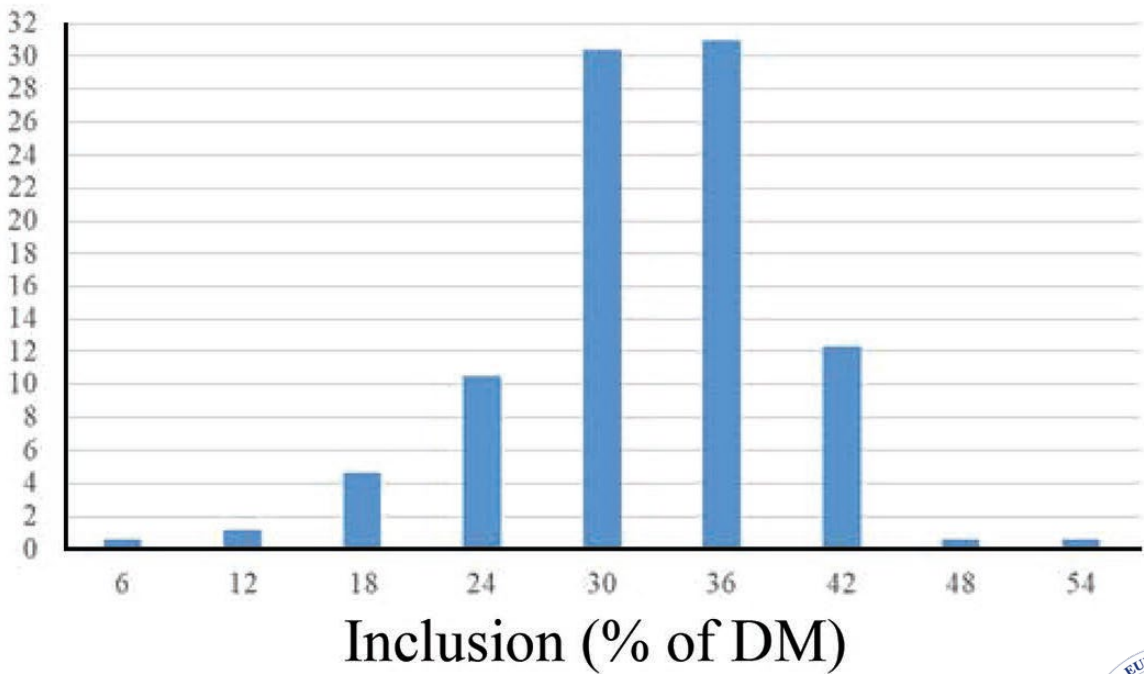
produce il **47%** del latte italiano (Gen - Apr 2024)

Source: CLAL



Utilization of main ingredients (% of farms that use the feed) in the lactating cow TMR

Source: Gislon et al. (2020)



Corn silage inclusion (% of DM) in the lactating cow TMR



Objective

This study aimed to evaluate the nutritional composition of a significant number of corn silages, from Northern Italy, through the use of near-infrared spectroscopy (NIRS)



Material & method

Samples collection and preparation

6952 corn silage collected by the Regional Breeders Association of Lombardy (2017-2023)

Oven-drying (Binder GmbH, Tuttlingen, Germany) at 60°C for 48 h, and milling knife mill with 1mm diameter sieve (Retsch GmbH, Hann, Germany)

Dry matter (DM) determination

According to Reg. EU 152/2009

Near-infrared spectroscopy analysis (NIRSystem 5000, FOSS)

Crude protein, crude fat, crude fiber, neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), starch and ash

Statistical analysis (IBM SPSS Statistics)

Descriptive analysis to determine average contents and standard deviation

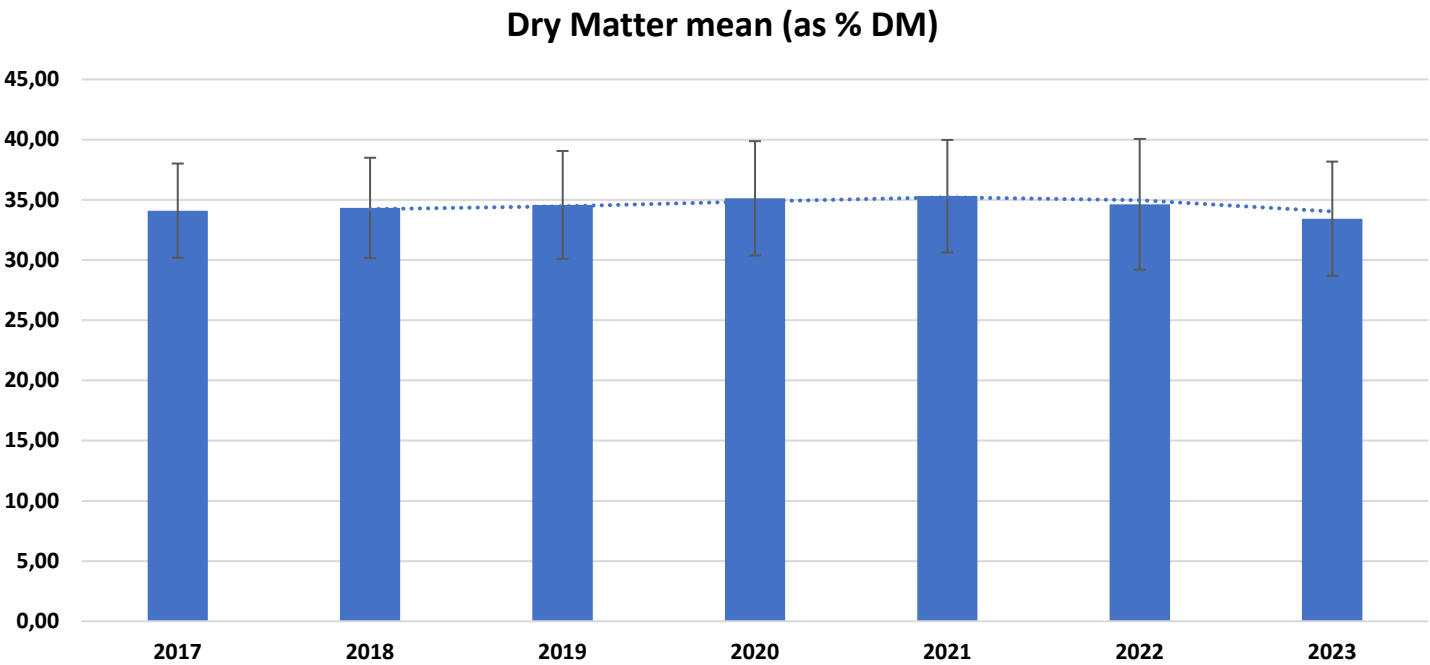
One-way analysis of variance (ANOVA) to compare means



Results

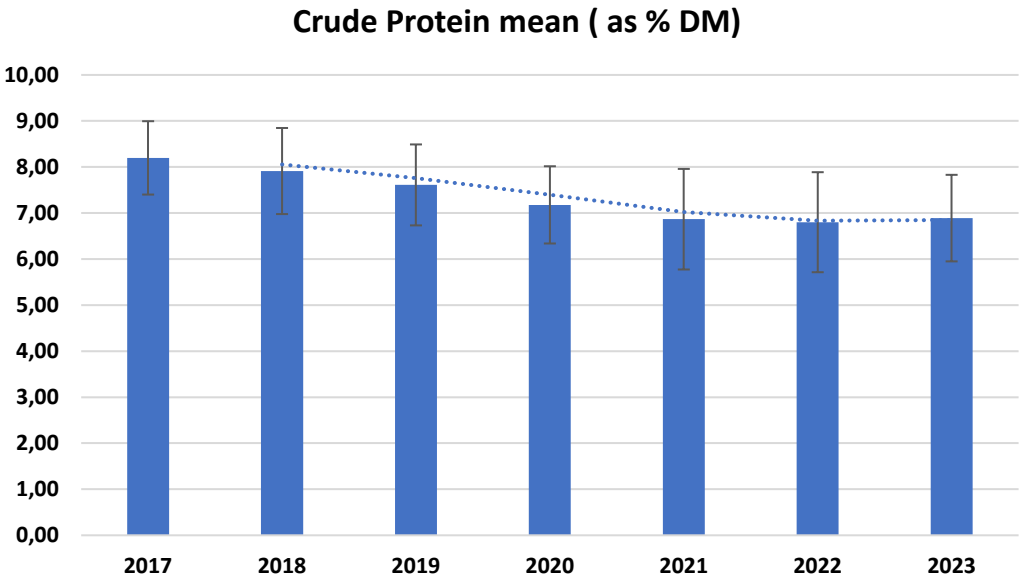
Year	N samples	DM	
		Avg	SD
2017	409	34.10	3.913
2018	1074	34.32	4.169
2019	1051	34.58	4.476
2020	1196	35.12	4.749
2021	1082	35.30	4.670
2022	1622	34.63	5.428
2023	518	33.43	4.742

Range DM: 33 - 35%



Results

Year	N samples	CP	
		Avg	SD
2017	409	8.20	0.797
2018	1074	7.91	0.935
2019	1051	7.61	0.879
2020	1196	7.18	0.839
2021	1082	6.87	1.092
2022	1622	6.80	1.086
2023	518	6.89	0.940



Range CP: 6,8 – 8,2%

Protein predicted by NIRS						
HSD di Tukey						
Year	N	Subsets				
		1	2	3	4	5
2022	1622	6,80				
2021	1082	6,87				
2023	518	6,89				
2020	1196		7,18			
2019	1051			7,61		
2018	1074				7,91	
2017	409					8,20
Sig.		0,512	1,000	1,000	1,000	1,000

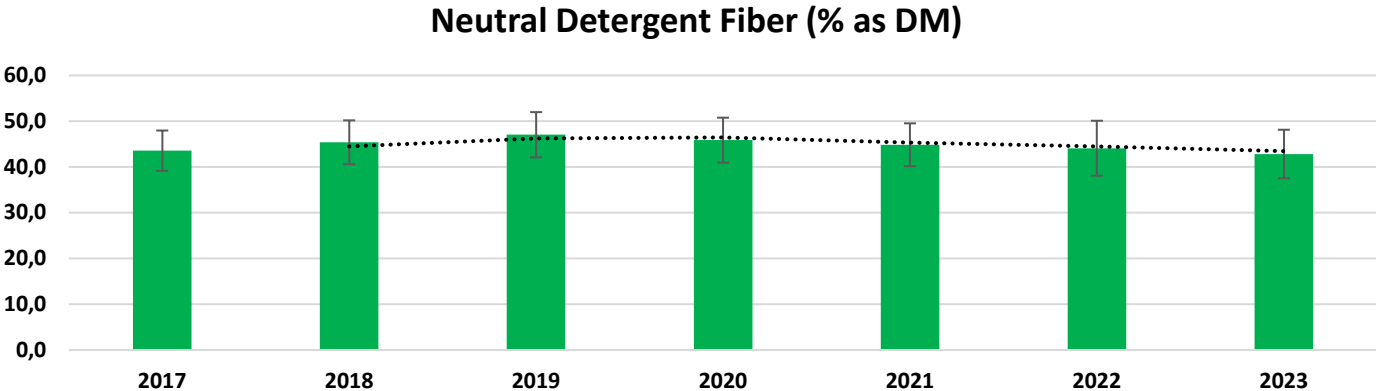
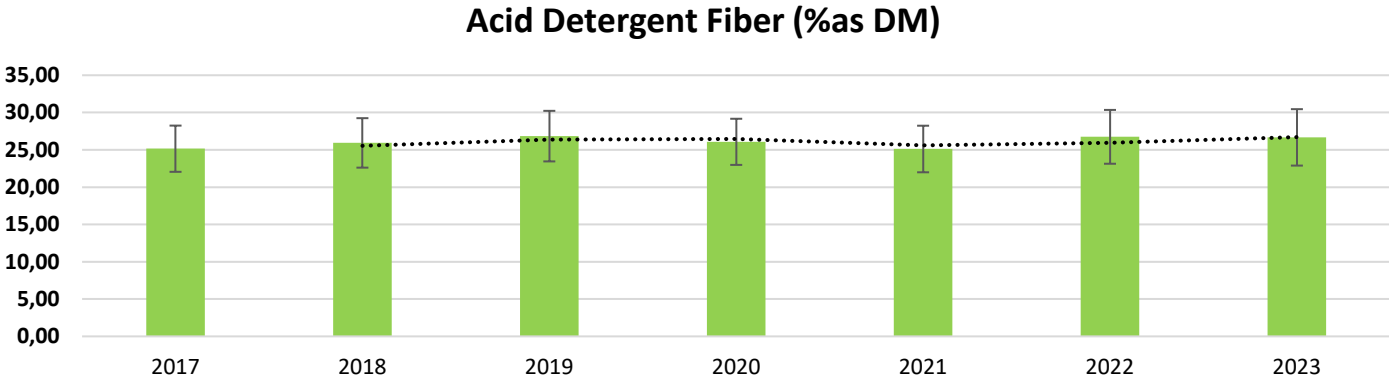
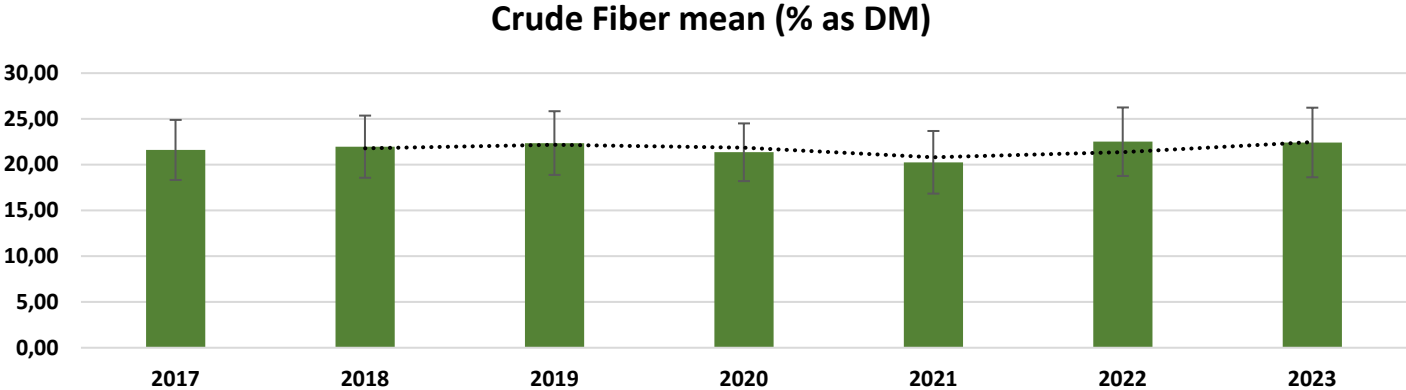


Results

Year	N samples	CF	
		Avg	SD
2017	409	21.61	3.281
2018	1074	21.97	3.397
2019	1051	22.36	3.480
2020	1196	21.36	3.152
2021	1082	20.26	3.421
2022	1622	22.51	3.742
2023	518	22.42	3.801

Year	N samples	ADF	
		Avg	SD
2017	409	25.15	3.10
2018	1074	25.93	3.32
2019	1051	26.84	3.39
2020	1196	26.08	3.09
2021	1082	25.11	3.12
2022	1622	26.67	3.78
2023	518	26.17	3.41

Year	N samples	NDF	
		Avg	SD
2017	409	43.6	4.404
2018	1074	45.4	4.789
2019	1051	47.0	4.939
2020	1196	45.9	4.909
2021	1082	44.9	4.684
2022	1622	44.1	6.004
2023	518	42.8	5.299



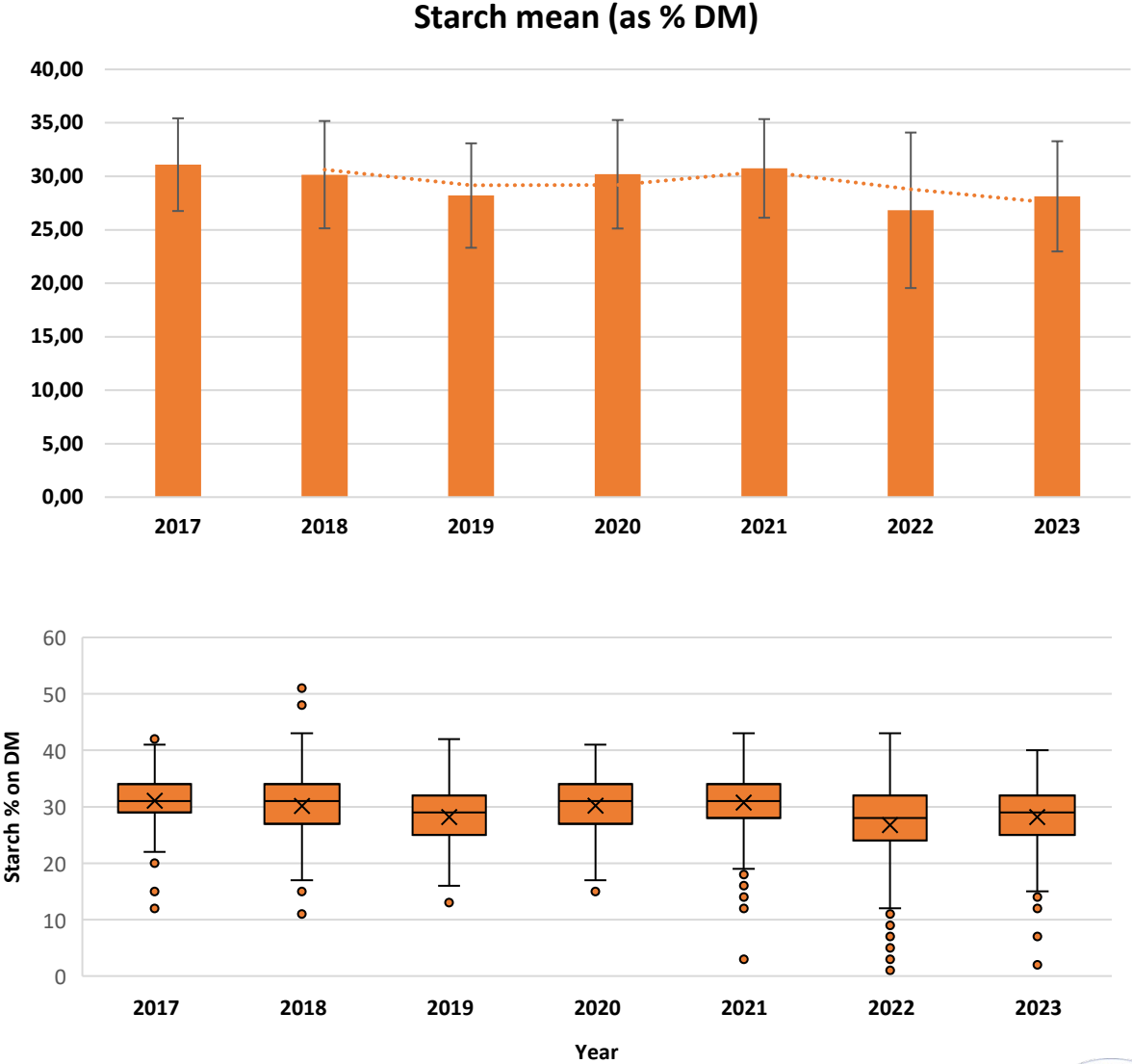
Range
CF: 20,2– 22,5%
ADF: 25,1-26,8 %
NDF: 42,8-47 %



Results

Year	N samples	Starch	
		Avg	SD
2017	409	31.09	4.335
2018	1074	30.16	5.019
2019	1051	28.20	4.884
2020	1196	30.19	5.073
2021	1082	30.74	4.611
2022	1622	26.82	7.271
2023	518	28.13	5.154

Range Starch: 26,8– 31 %



Results

Crude Fiber predicted by NIRs

HSD di Tukey

Year	N	Subsets				
		1	2	3	4	5
2021	1082	20,26				
2020	1196		21,36			
2017	409		21,61	21,61		
2018	1074			21,97	21,97	
2019	1051				22,36	22,36
2023	518				22,42	22,42
2022	1622					22,51
Sig.		1,000	0,774	0,375	0,110	0,979

Starch predicted by NIRs

HSD di Tukey

Year	N	Subsets			
		1	2	3	4
2022	1622	26,82			
2023	518		28,13		
2019	1051		28,20		
2018	1074			30,16	
2020	1196			30,19	
2021	1082			30,74	30,74
2017	409				31,09
Sig.		1,000	1,000	0,343	0,860

ADF predicted by NIRs

HSD di Tukey

Year	N	Subsets		
		1	2	3
2021	1082	25,11		
2017	409	25,15		
2018	1074		25,93	
2020	1196		26,08	
2023	518			26,67
2022	1622			26,75
2019	1051			26,84
Sig.		1,000	0,978	0,952

Results

Corn silage mean nutritional composition (as % DM) (2017-2023)

	Mean ± SD
DM	34,65 ± 4,761
CP	7,26 ± 1,076
CL	2,40 ± 0,513
CF	21,80 ± 3,565
NDF	45 ± 5,278
ADF	26,17 ± 3,41
ADL	2,71 ± 0,614
Starch	29,08 ± 5,750
Ash	3,87± 0,797
NEL	1,57-1,62 (Mcal/Kg)

US corn silage range nutritional composition (as % DM)

	Range
DM	30-40%
CP	6-10 %
NDF	36-50%
ADF	18-26%
ADL	2-4%
Starch	25-35%
NEL	1,4-1,64 (Mcal/Kg)

Source: Crop science, US (Bayer) Interpreting corn silage quality test results (2024)



Conclusion

- The corn silage's average nutritional composition is in the normal ranges
 - Protein decreased up to 1,5%
 - Starch fluctuating trend
 - Fiber and ADF tended to increase, NDF tended to decrease
- Essential to monitor the feed nutritional values, NIRS represents a valid technique
- Could climatic factors affect the nutritional composition of corn silage ???



Thank you for your attention



Rossella.Abbate@unimi.it;
Matteo.Ottoboni@unimi.it;
Alice.Luciano@unimi.it;
Luciano.Pinotti@unimi.it

