Cheese-making properties and cheese yield of milk from Holsteins and 3-way rotational crossbred cows

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DEPARTMENT AGRONOMY FOOD NATURAL RESOURCES ANIMALS ENVIRONMENT

Introduction

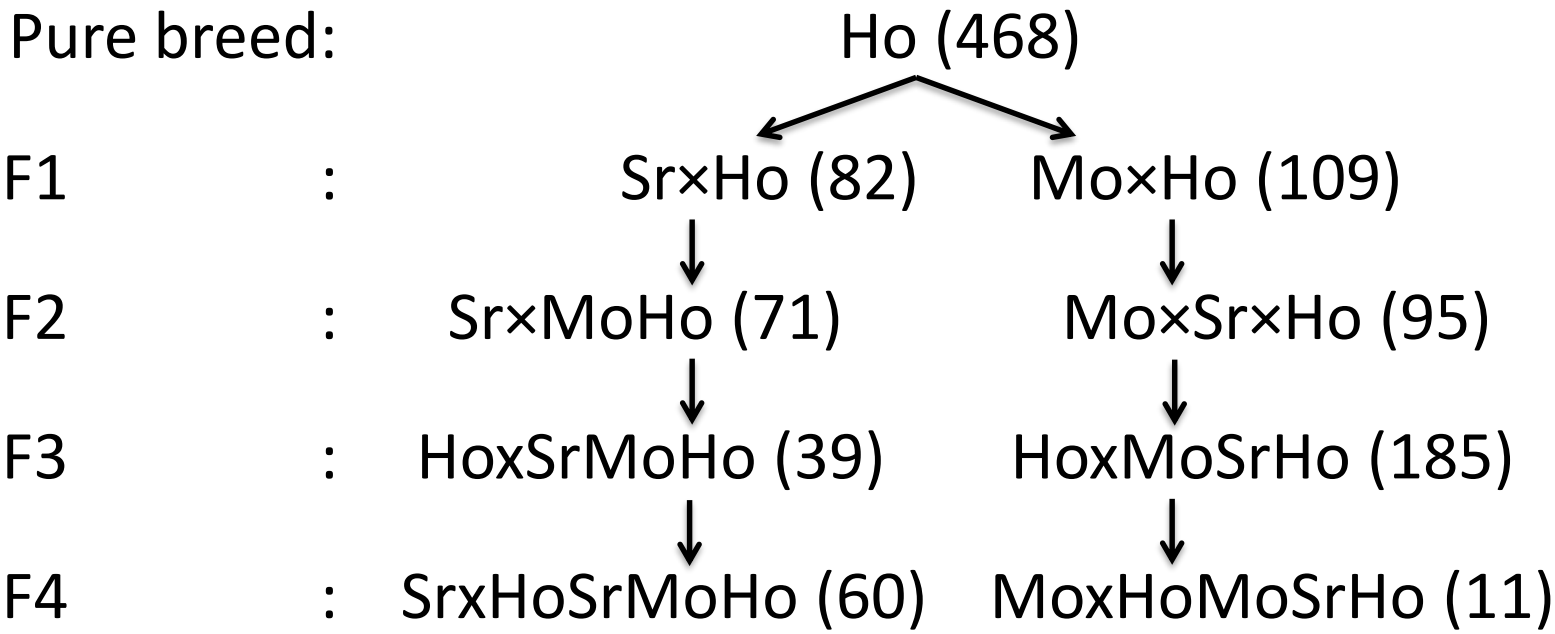
- crossbreeding of dairy cattle is on the rise globally because of decling fertility, health and survival of pure Holstein
- most of the research focused on effects of crossbreeding on cow fertility, health, milk production and composition
- effects of crossbreeding on milk coagulation properties and cheese yield have not been properly explored

Objectives

- To investigate effect of 3-way rotational crossing of Holstein (Ho) cows with Swedish Red (Sr), Montbeliarde (Mo) and Ho sire on
  - milk yield and composition traits
  - coagulation and curd firming traits
  - cheese yield traits

Materials and Methods

- 2 farms of nothern Italy following a **3-breed rotational crossbreeding scheme** since > 10 years
- **1120** cows involved:



Materials and Methods

- milk yield and fat and protein content from official recording association
- individual milk samples (100 ml) from evening milking, immediately frozen and analyzed for:
  - milk composition (Milkoscan FT2)
  - milk coagulation properties (Lactodynamographs)
  - curd firming parameters (Bittante et al., 2013)
  - curd yield (Cipolat-Gotet et al., 2016)

Statistical analysis

- Data were analyzed by using a mixed model:
  - Fixed effects: Farms, parity, days in milk and breed combinations
  - Random effect: Date of sample analysis (39 levels)
- orthogonal contrasts estimated between LS means of traits for the effects of breed combinations:

HO vs crosses	within F1
F1 vs (F2+F3+F4)	within F2
F2 vs (F3+F4)	within F3
F3 vs F4	within F4

RESULTS

Milk yield and composition

Item	MY	Fat	Prot	Lact	SCS
	kg/d	%	%	%	
Ho	34.1	3.82	3.62	5.11	2.82
F1 Sr×Ho	32.0	4.03	3.74	5.04	2.66
F1 Mo×Ho	32.0	3.88	3.69	5.10	2.70
F2 SrxMoHo	30.1	3.93	3.70	5.06	2.85
F2 MoxSrHo	31.7	3.78	3.62	5.05	2.50
F3 HoxSrMoHo	31.8	3.64	3.61	5.07	2.72
F3 HoxMoSrHo	32.1	3.89	3.70	5.09	2.49
F4 SrxHoSrMoHo	29.2	4.19	3.82	4.99	2.48
F4 MoxHoMoSrHo	31.3	4.01	3.61	5.08	2.25
SEM	1.05	0.11	0.04	0.02	0.21
(avg crosses)	31.3	3.92	3.69	5.06	2.58

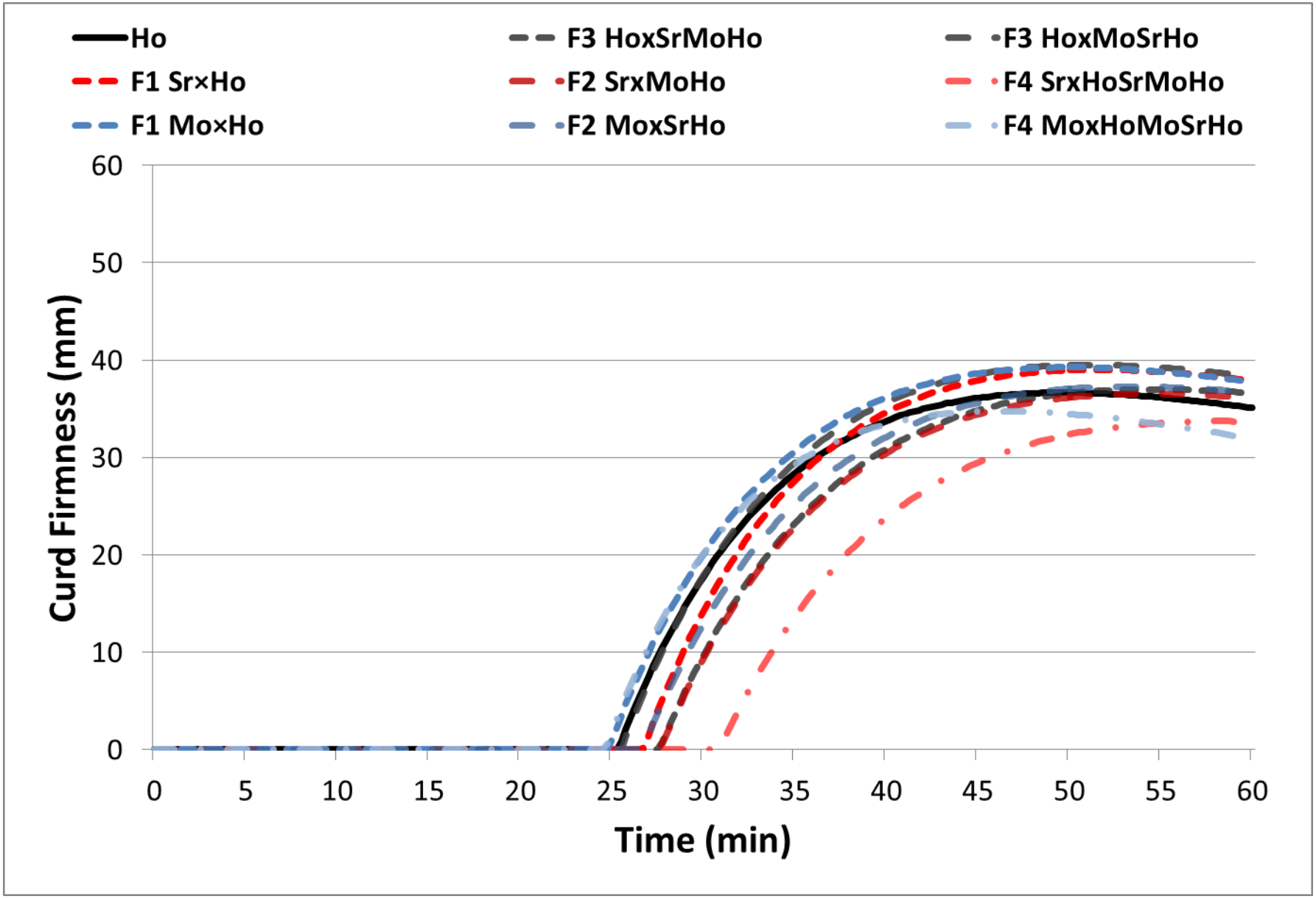
Samples (%) not coagulating

	after 30 min	after 45 min	after 60 min
Ho	21.15	5.34	3.85
F1 Sr×Ho	29.27	9.76	8.54
F1 Mo×Ho	7.34	0.00	0.00
F2 SrxMoHo	8.45	2.82	5.63
F2 MoxSrHo	27.37	8.42	5.26
F3 HoxSrMoHo	21.62	5.41	0.00
F3 HoxMoSrHo	15.68	2.70	1.08
F4 SrxHoSrMoHo	21.67	1.67	0.00
F4 MoxHoMoSrHo	9.09	0.00	0.00
(avg crosses)	17.56	3.85	2.56

Milk coagulation properties

Item	RCT	k_{20}	a_{30}	a_{45}	a_{60}
	min	min	mm	mm	mm
Ho	24.88	6.99	21.62	30.26	30.29
F1 Sr×Ho	26.44	6.40	22.92	29.87	30.46
F1 Mo×Ho	24.58	6.53	23.51	33.34	33.96
F2 SrxMoHo	27.29	7.29	15.17	27.69	29.28
F2 MoxSrHo	26.22	6.95	18.77	30.12	31.87
F3 HoxSrMoHo	27.27	7.79	18.62	28.71	31.00
F3 HoxMoSrHo	25.11	6.35	22.49	33.15	33.63
F4 SrxHoSrMoHo	30.52	8.13	9.91	25.64	28.95
F4 MoxHoMoSrHo	24.25	6.86	21.70	27.43	28.01
SEM	1.11	0.41	2.22	1.94	1.81
(avg crosses)	26.46	7.04	19.14	29.50	30.90

Curd firming pattern



Curd and daily curd yield traits

Item	no yield	curd	Daily curd yield
	%	%	Kg/d
Ho	3.20	17.08	5.82
F1 Sr×Ho	7.32	17.36	5.42
F1 Mo×Ho	0.00	17.79	5.52
F2 SrxMoHo	2.82	17.67	5.27
F2 MoxSrHo	5.26	16.80	5.28
F3 HoxSrMoHo	0.00	17.06	5.34
F3 HoxMoSrHo	1.62	17.32	5.46
F4 SrxHoSrMoHo	0.00	18.02	5.17
F4 MoxHoMoSrHo	0.00	16.62	5.11
SEM		0.32	0.20
(avg crosses)	2.13	17.33	5.32

Conclusions

- when compared to purebred HO, crossbred cows showed:
  - < milk yield
  - > milk composition (→ variation among breed combinations)
  - < percentage of not coagulating samples (→ variation among breed combinations)
  - comparable MCP and curd firming pattern (but slightly greater RCT and huge variation among breed combinations)
  - comparable curd yield
  - as a consequence, < daily cheese yield per cow
- next step: comparison in term of productivity and efficiency

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Thank you for your attention!

Grazie per l'attenzione!

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Any Questions?

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