



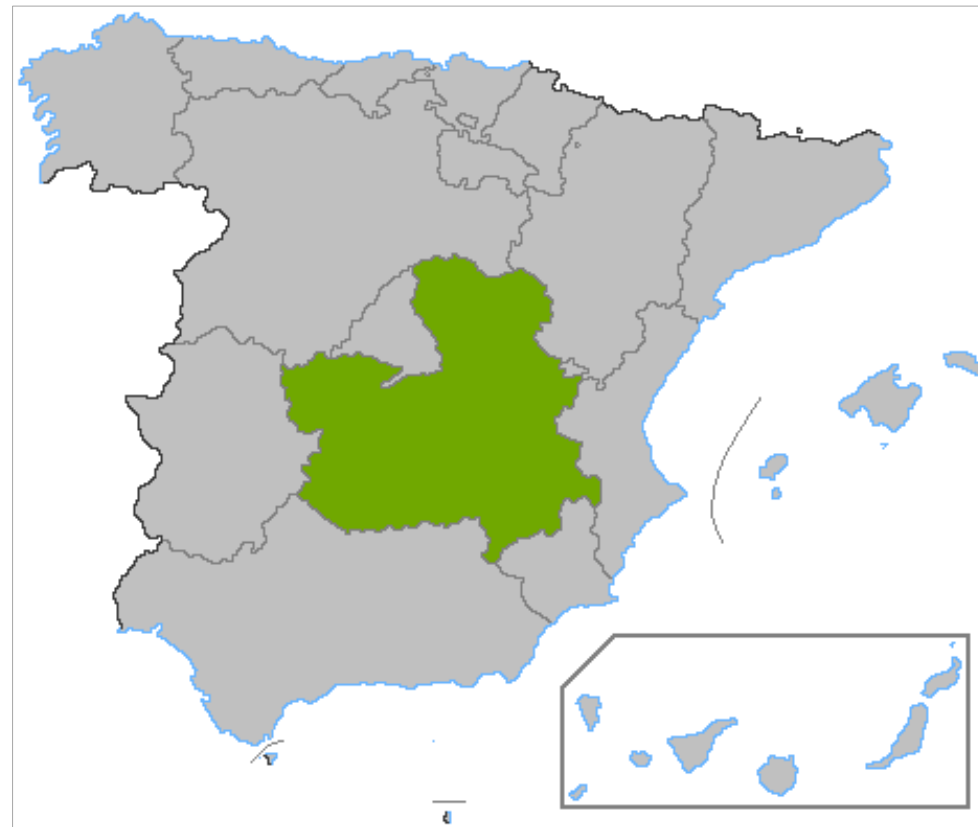
Heritability of traditional milk coagulation properties in Manchega dairy sheep

Heddi, I., Garzón, A., Arias, R., Jiménez, L., Cecchinato, A., Amalfitano, N., Caballero-Villalobos, J., Ramon, M

The 75th EAAP Annual Meeting
1/5 September 2024 - Florence, Italy



Manchega Sheep



Localization: la Mancha



- Milk production ability
- MP in 161 days: 248 L
- F: 6.1 % , P: 5.6 %



Manchego cheese

Manchego Cheese



Since 1985: PDO



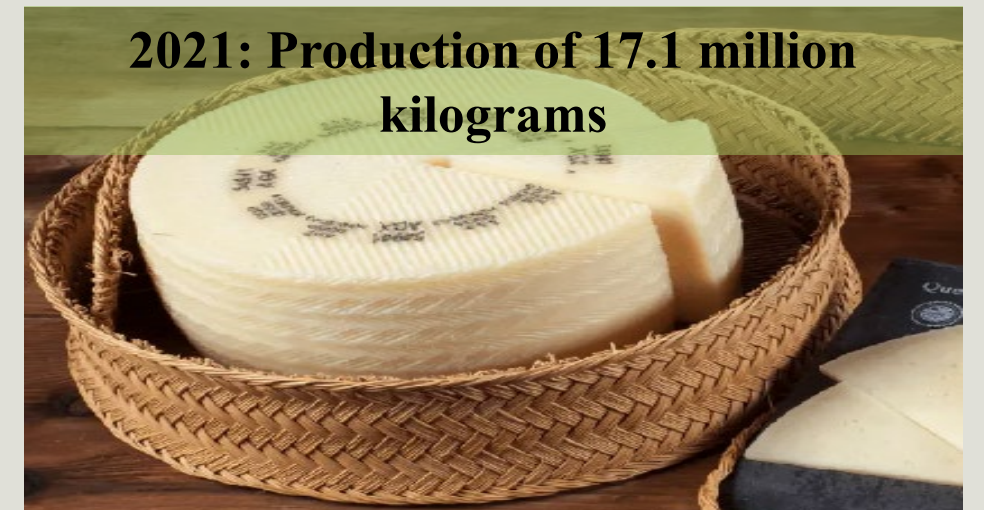
Cheese production



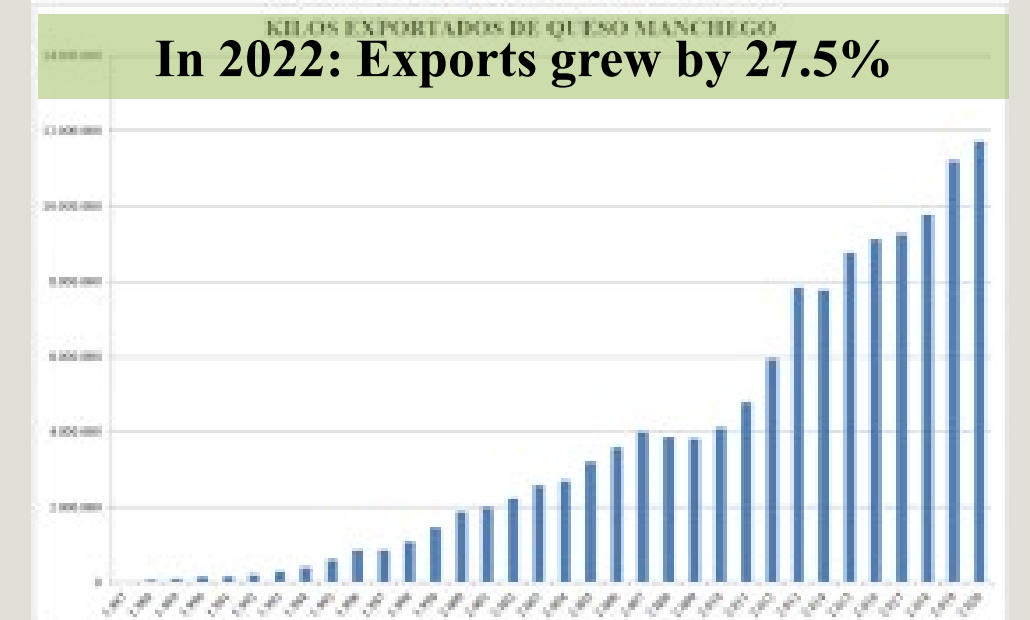
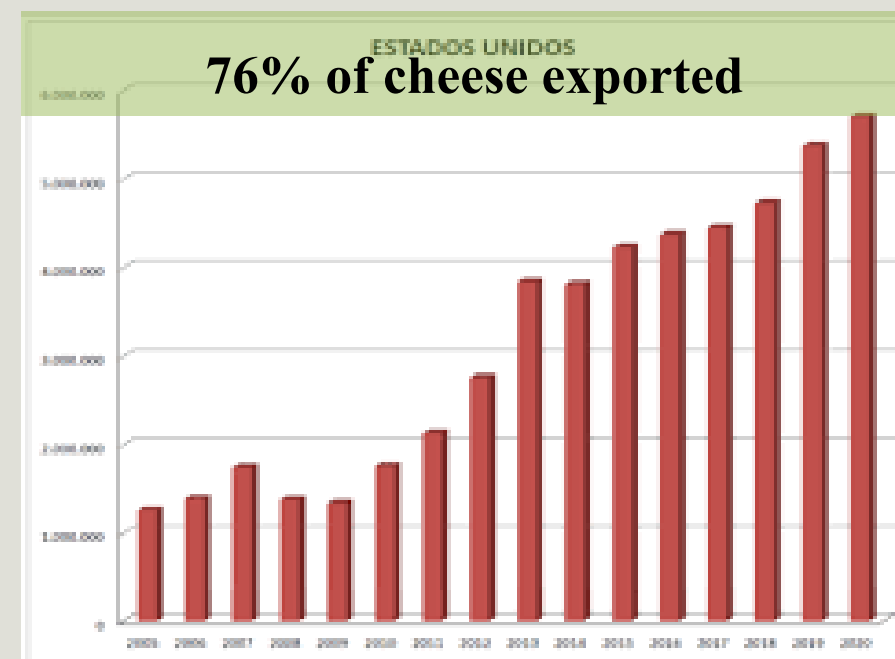
Export: US



Export growth



2021: Production of 17.1 million kilograms



Breeding Program



ASOCIACION NACIONAL DE CRIADORES DE GANADO OVINO SELECTO DE RAZA MANCHEGA

ASOCIACION DE CRIADORES DE GANADO OVINO DE RAZA PURA

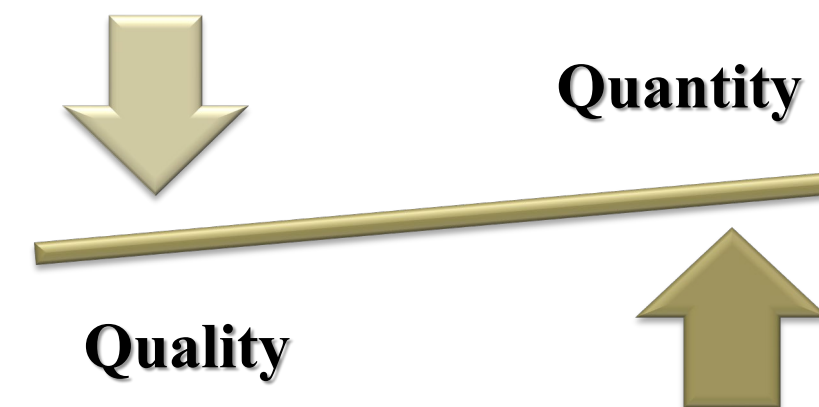
RECONOCIDA OFICIALMENTE POR EL MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN

PROGRAMA DE CRIA DE LA RAZA OVINA MANCHEGA

Reglamento 2016/1012

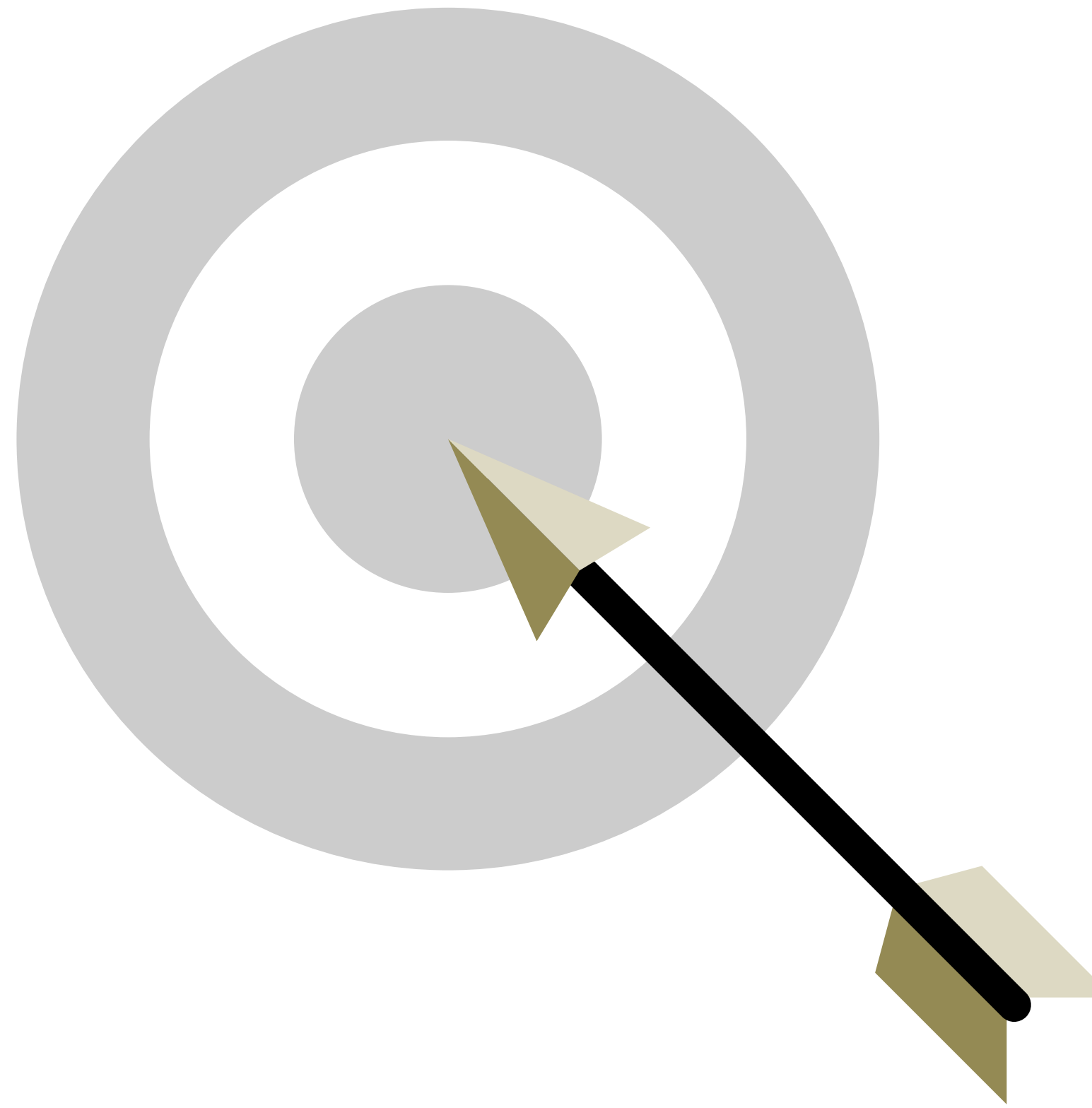
Aprobado mediante la Resolución de la Dirección General de Producciones y Mercados Agrarios de 22 de enero de 2020: Versión actualizada y consolidada a 10 de octubre de 2022

Objective of selection: Enhancing milk production per ewe y lactation

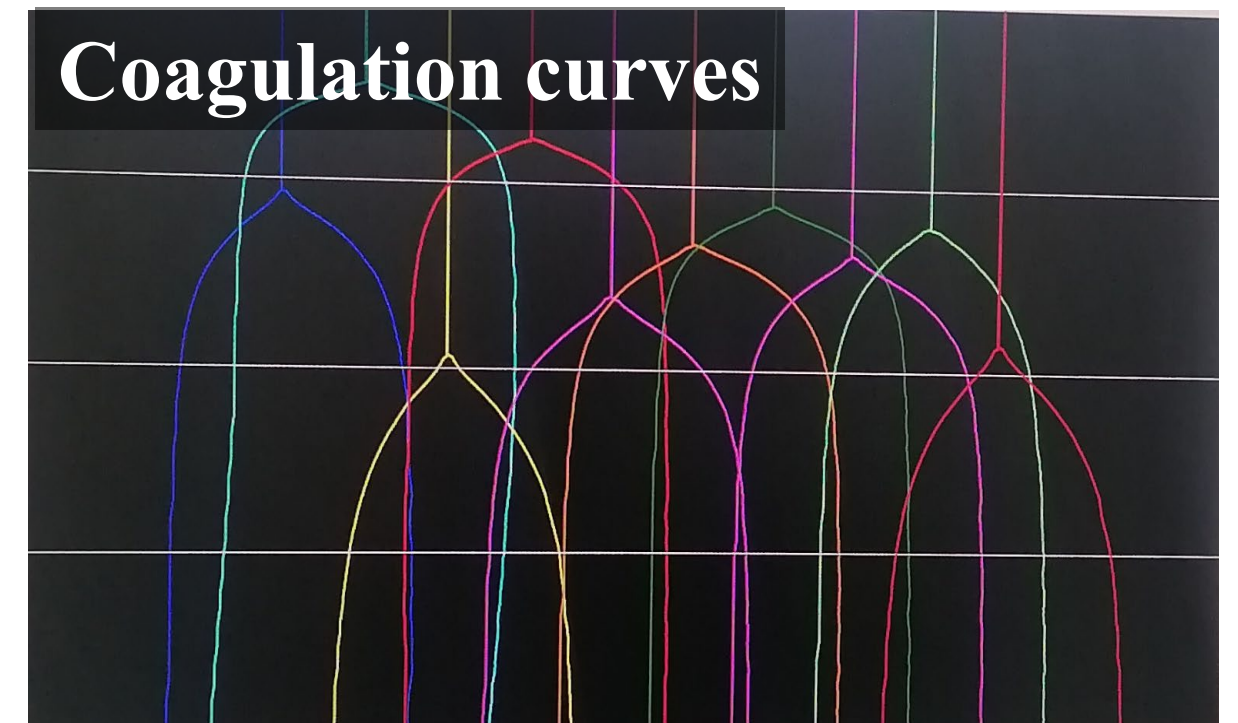
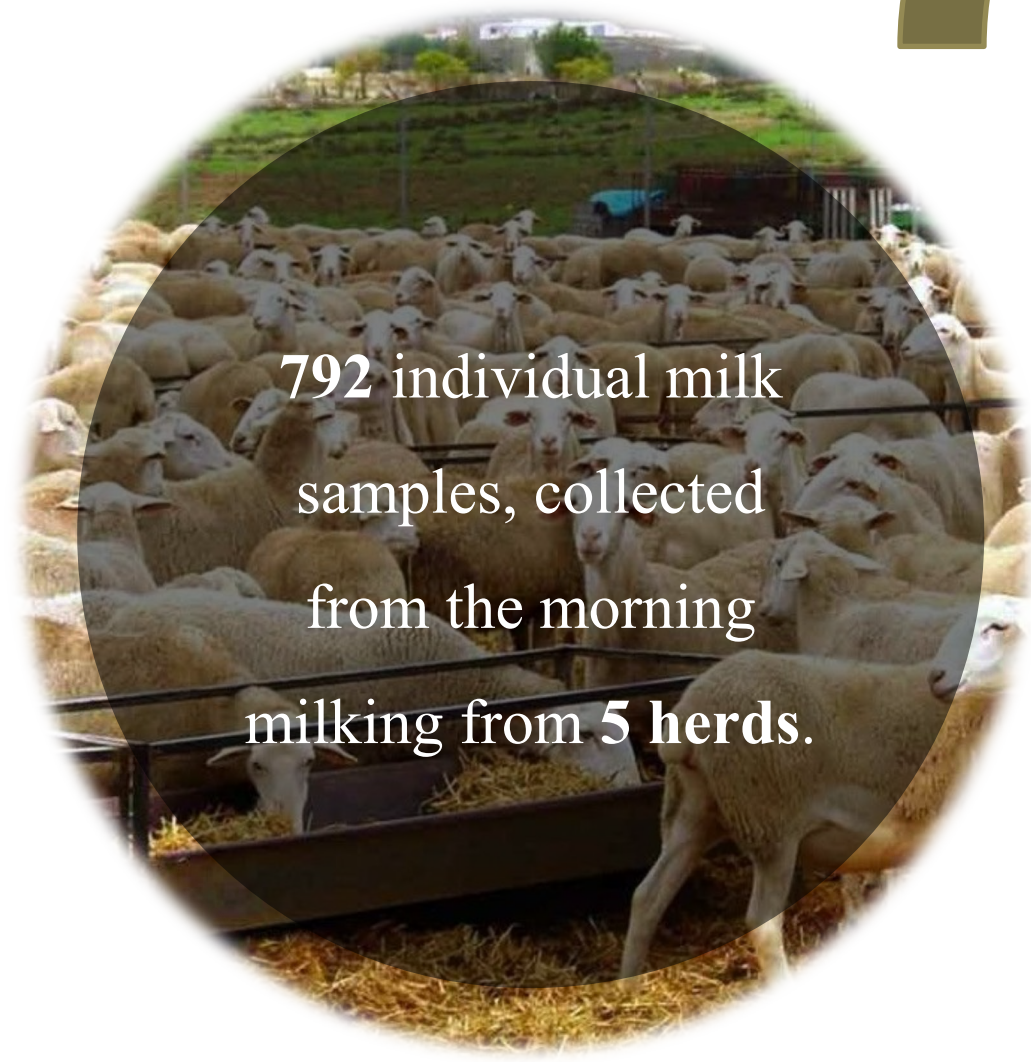


The aim of this study

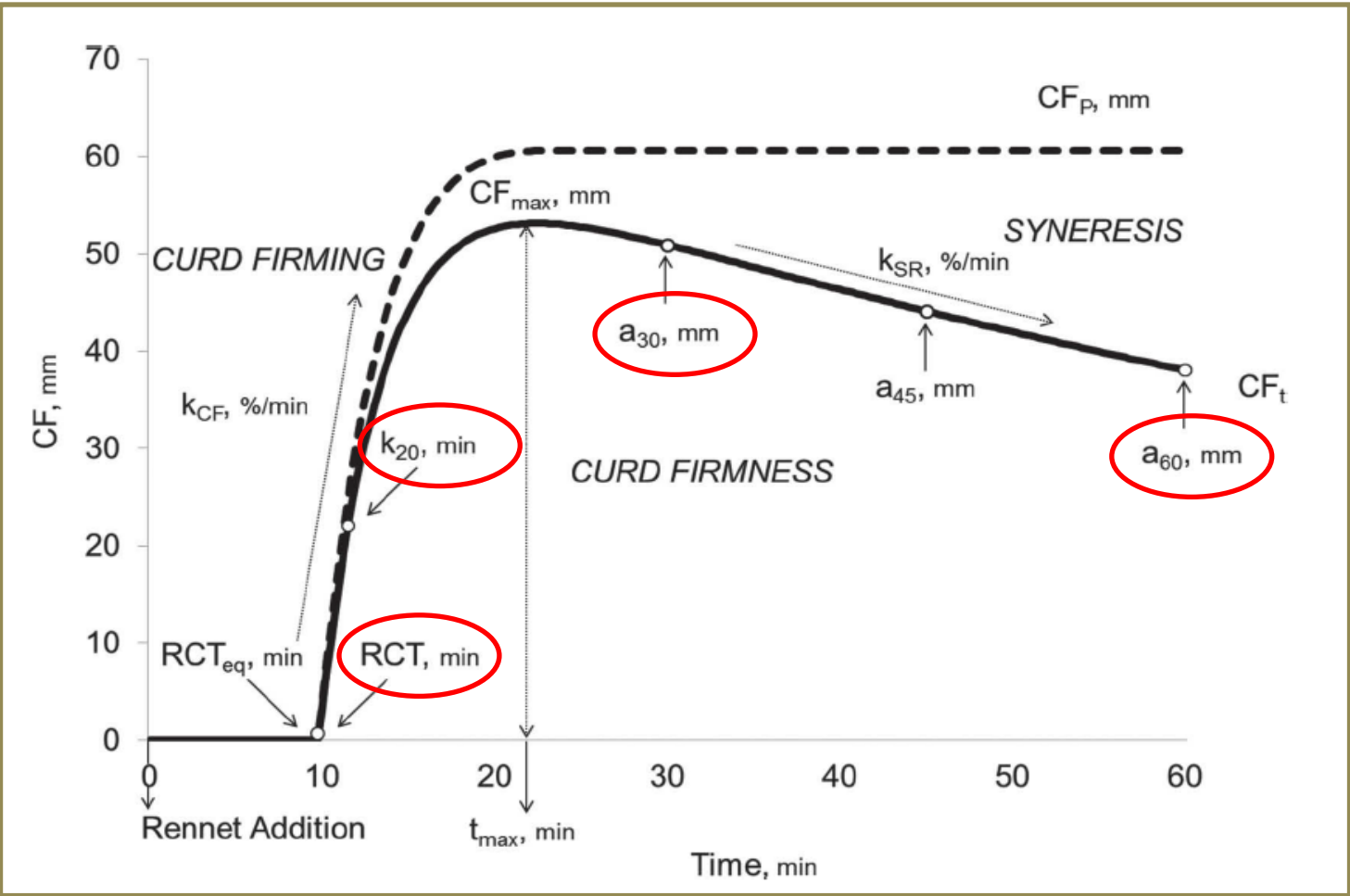
- Estimate the heritability of the traditional coagulation properties (MCP) in the Manchega breed.
- Estimate the genetic correlations between MCP and cheese-making ability traits.



Estimating the traditional coagulation properties (MCP)



Estimating the traditional coagulation properties (MCP)



RCT Rennet coagulation time min

K₂₀ Curd-firming time min

A₃₀ Curd firmness measured at 30 min mm

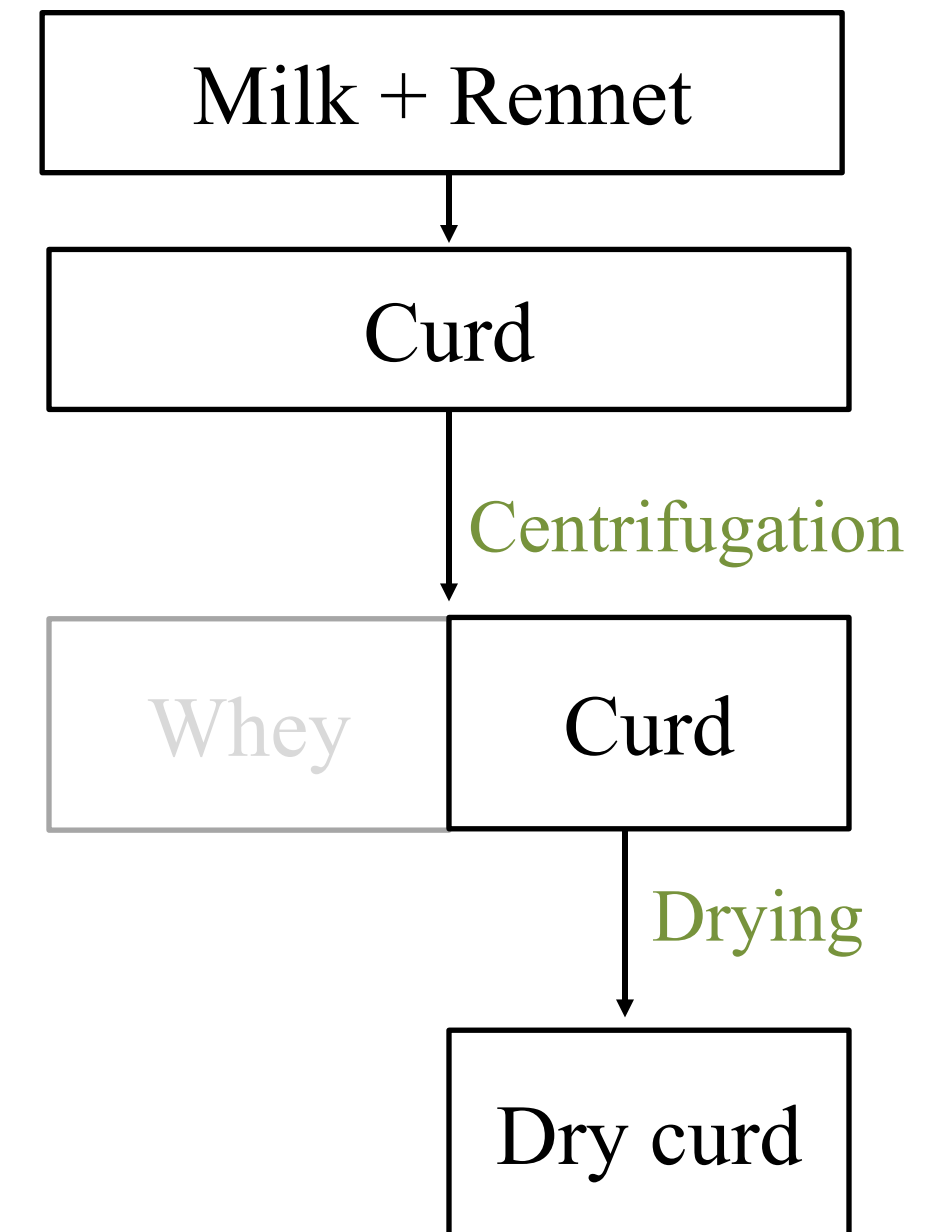
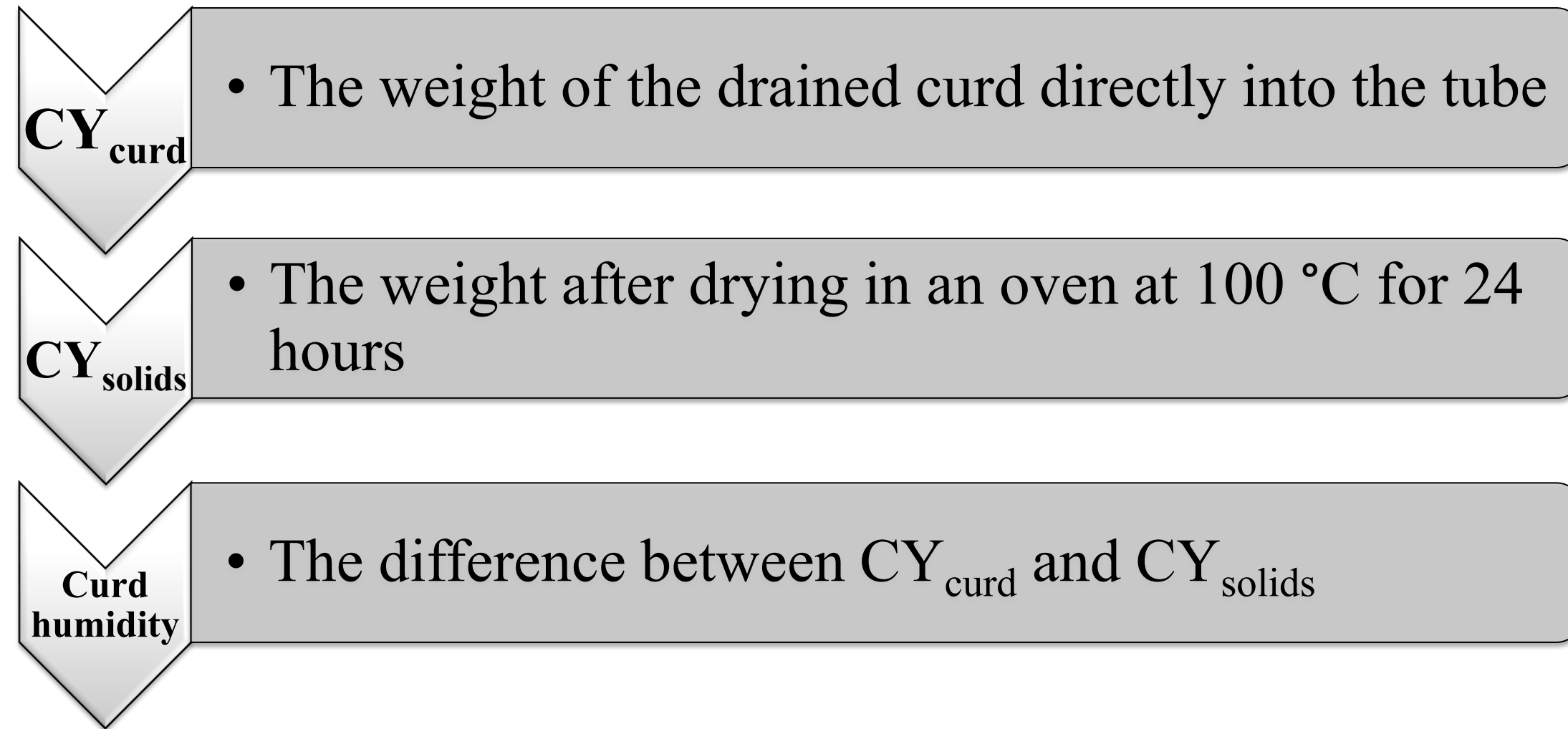
A₆₀ Curd firmness measured at 60 min mm

MCP

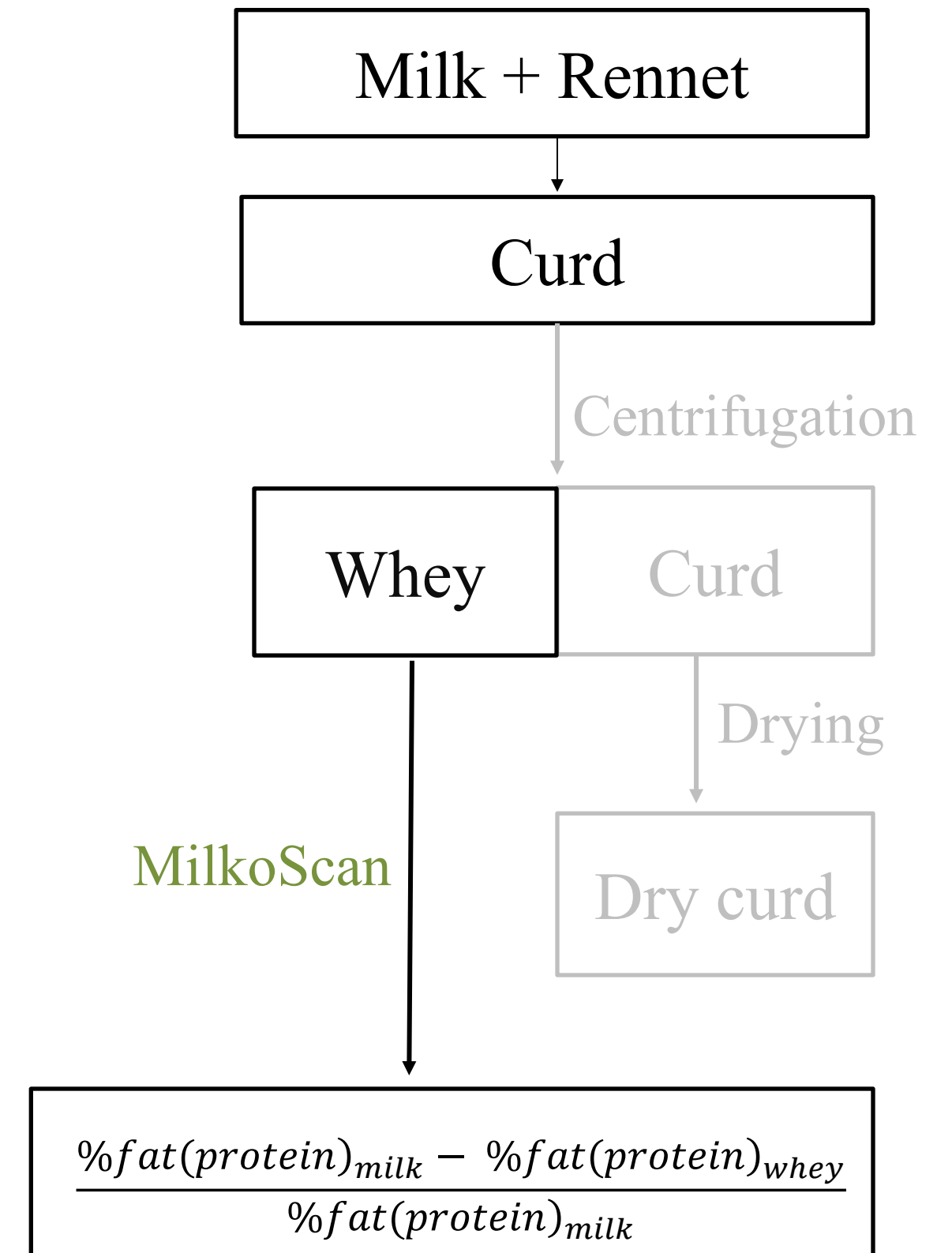
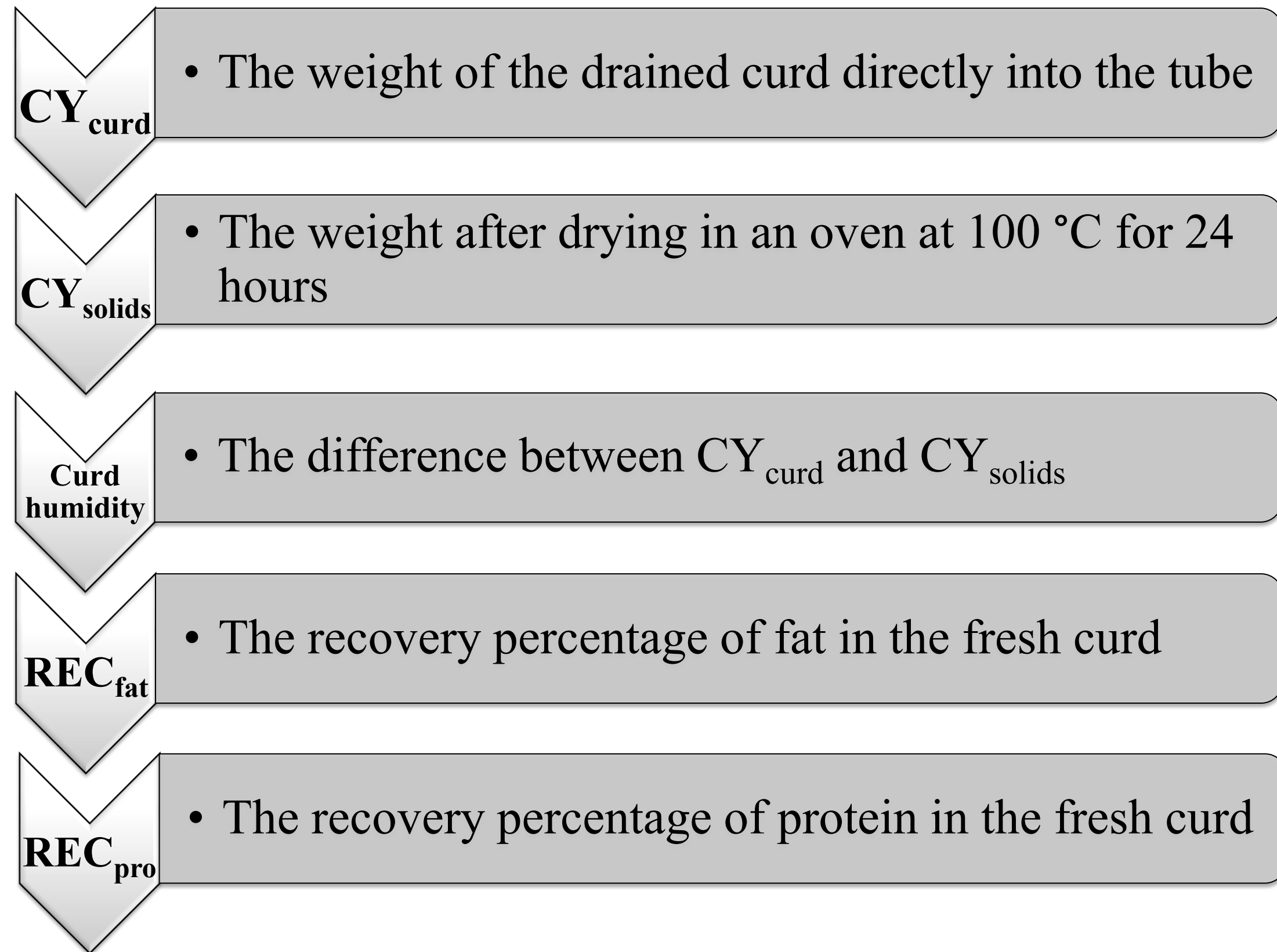


Traditional coagulation **single point trait**

Estimating the cheese-making ability traits



Estimating the cheese-making ability traits



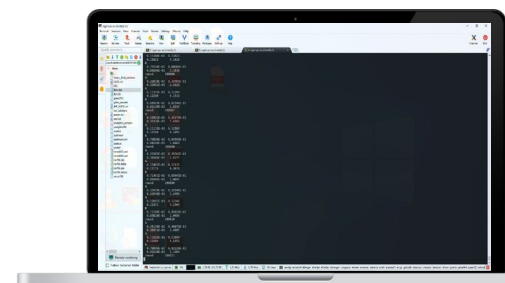
Statistical analysis

$$Y_{ijklm} = \mu + \text{DH}_i + \text{TP}_j + \text{EN}_k + \text{DIM}_l + A_m + e_{ijklm}$$

- Y_{ijklm} = Dependent variable
- μ = Population mean
- CR_i = Random effect of control-date and herd i (11 levels)
- PT_j = Fixed effect of parity type j (2 levels)
- AN_k = Fixed effect of age at calving - parity number k (21 levels)
- DIM_l = Fixed effect of days in milk l (6 levels)
- A_m = Random additive genetic effect of individual m
- e_{ijklm} = Random residual

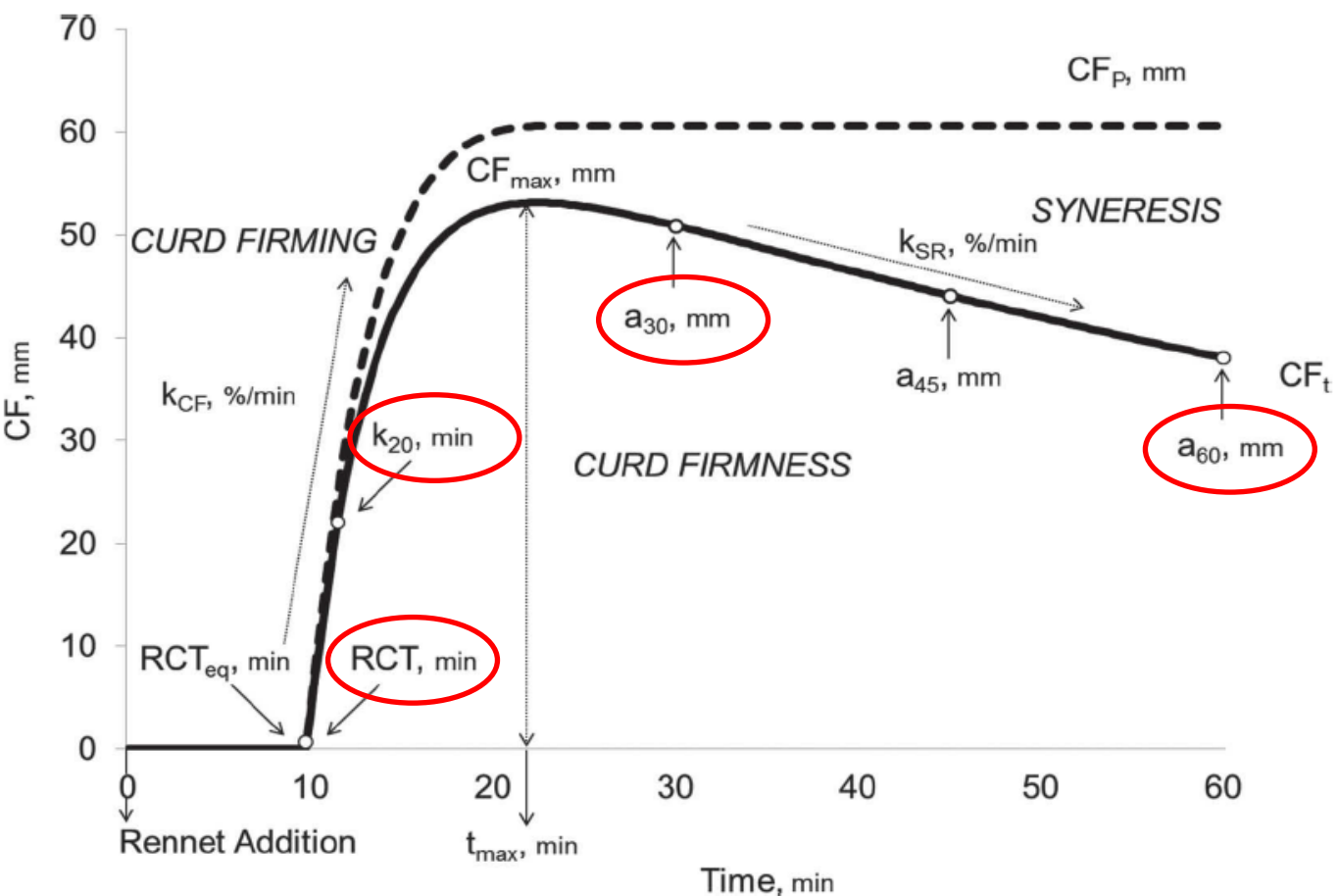


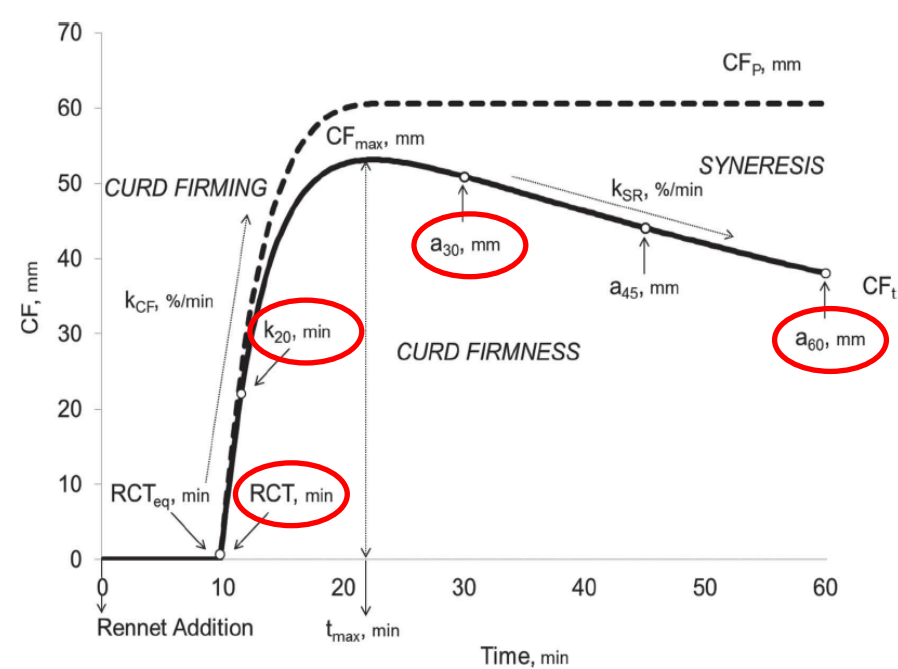
- Marginal Posterior Distribution: Gibbs sampling with the GIBBSF90 program
- MCMC Chains
- Estimation of genetic parameters : POSTGIBBSF90 program



Results: Descriptive statistics

	Mean	SD	P5	P95
RCT, min	21.36	8.03	11.12	37.62
K ₂₀ , min	2.77	1.63	0.00	5.75
A ₃₀ , mm	34.58	18.55	0.00	56.84
A ₆₀ , mm	49.48	8.79	32.34	61.74



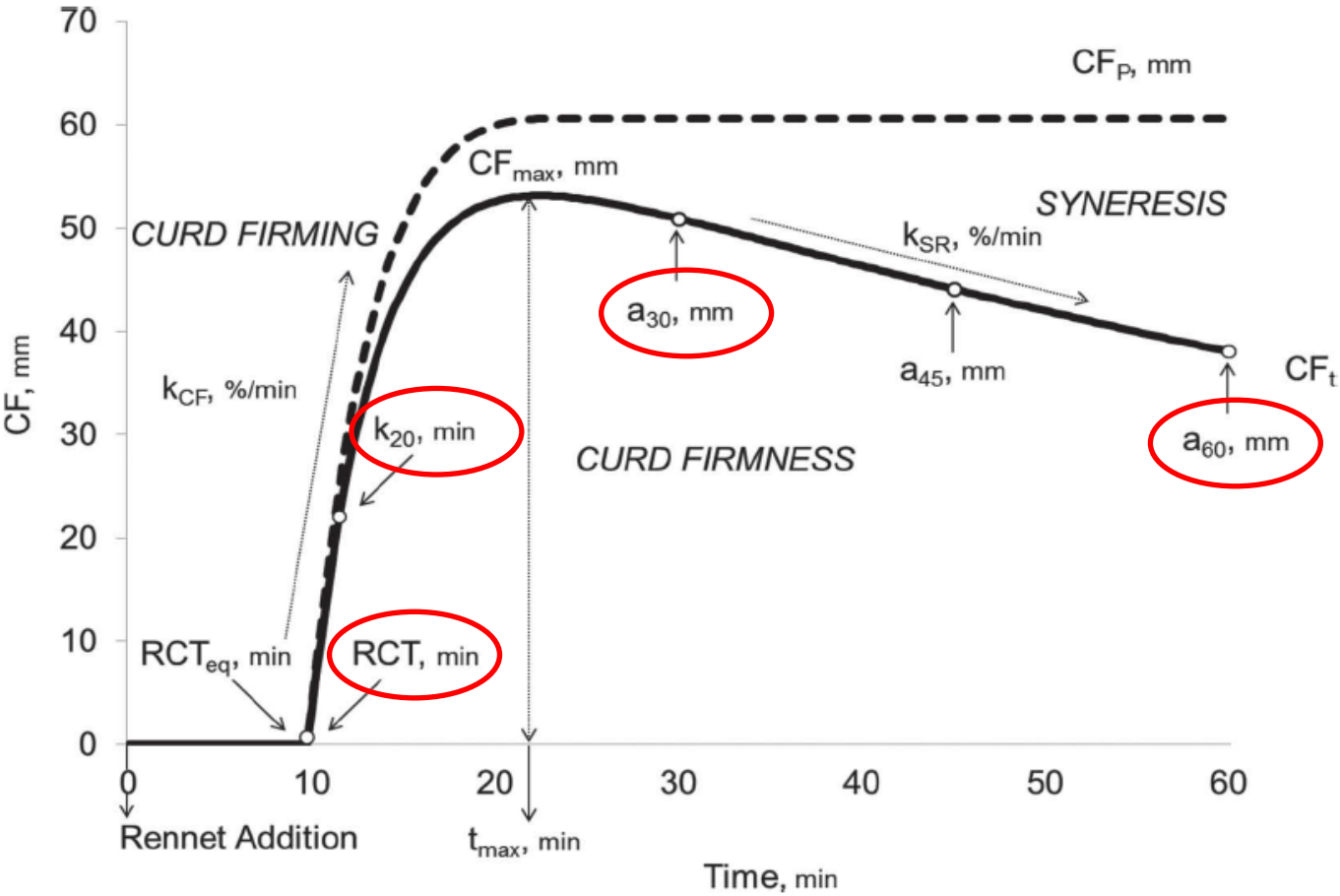


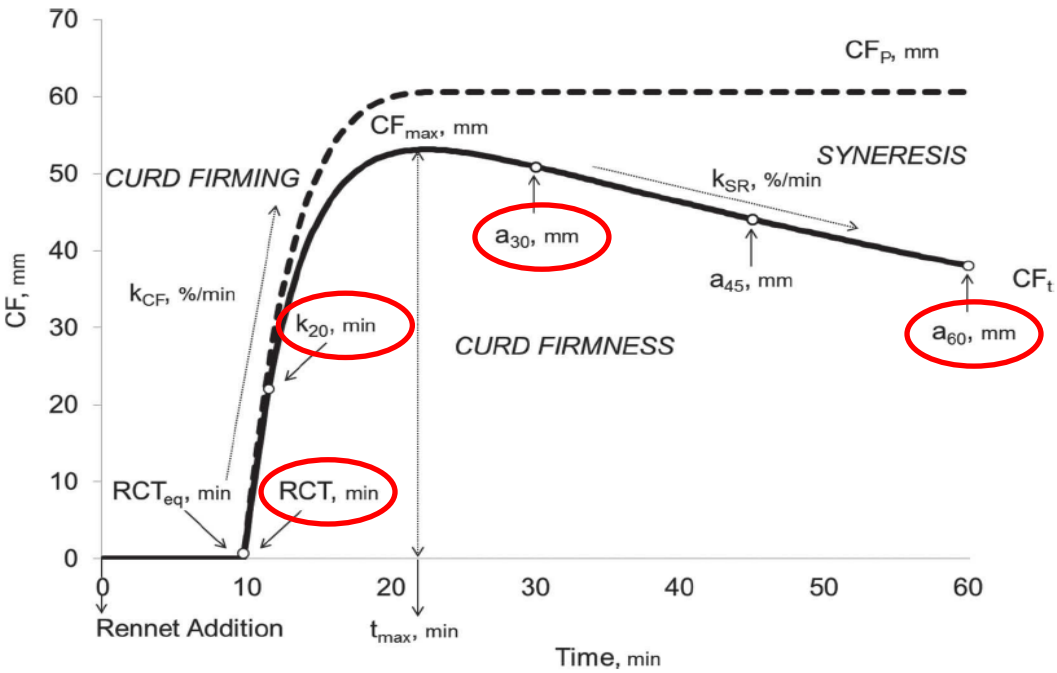
Results: Descriptive statistics

	Mean	Sánchez-Mayor et al.,2019 (Assaf)	Pazzola et al., 2017 (Sarda)	Pelayo y al., 2021 (Churra)
RCT, min	21.36	29.54	8.62	17.47
K ₂₀ , min	2.77	4.47	1.93	-
A ₃₀ , mm	34.58	28.9	50.21	36.81
A ₆₀ , mm	49.48	40.31	45.94	39.88

Results: Heritability

	h^2
RCT	0.16 [0.01 , 0.31]
LogK ₂₀	0.11 [0.003 , 0.23]
A ₃₀	0.14 [0.002 , 0.31]
A ₆₀	0.10 [0.003 , 0.24]



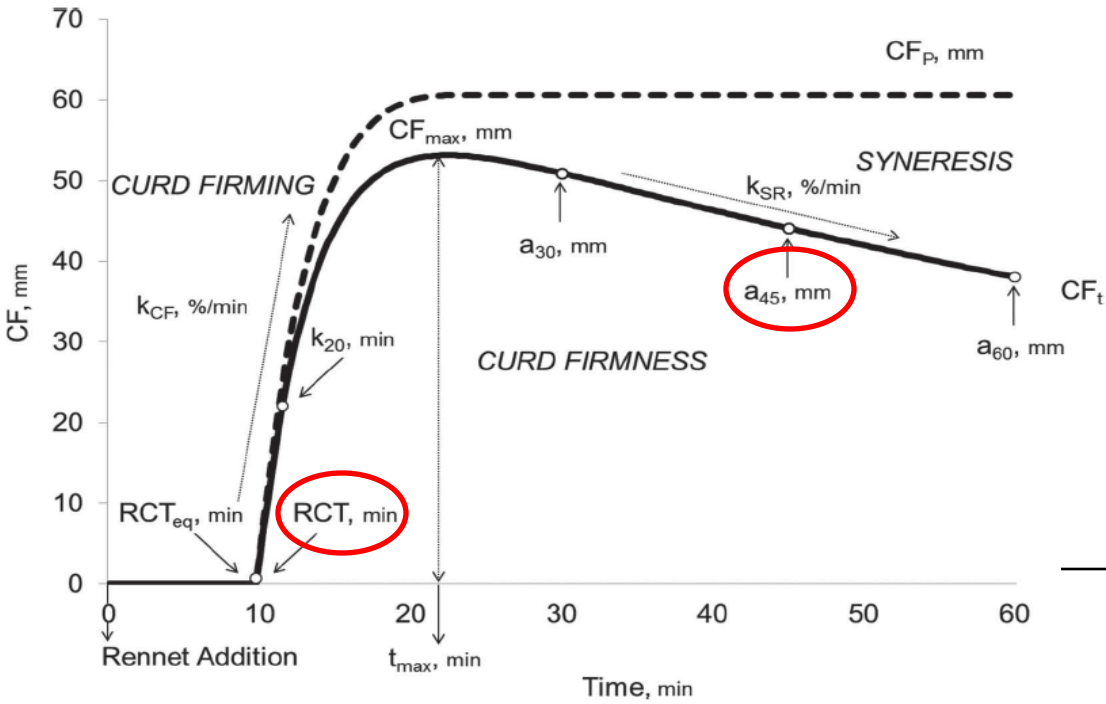


Results: Heritability

	h²	Bittante et al., 2017 (Sarda)	Sánchez-Mayor et al., 2019 (Assaf)	Pelayo et al., 2021 (Churra)
RCT	0.16 [0.01 , 0.31]	0.16	0.22	0.22
LogK₂₀	0.11 [0.003 , 0.23]	0.10	0.29	0.26
A₃₀	0.14 [0.002 , 0.31]	0.08	0.30	0.16
A₆₀	0.10 [0.003 , 0.24]	0.06	0.15	-

Results: genetic correlations between MCP
and cheese making ability traits

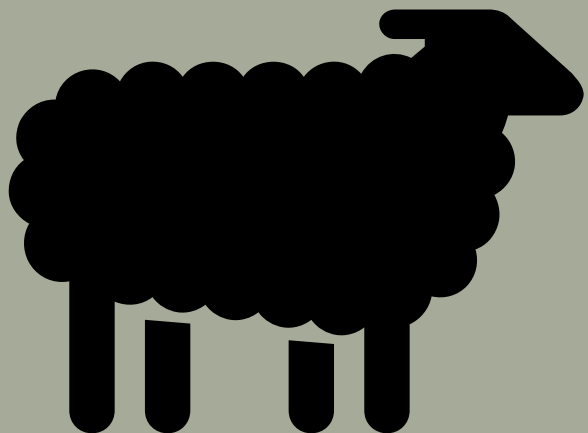
		CY _{curd}	CY _{solids}	CH	REC _{Fat}	REC _{Prot}
RCT	rg HPD _{95%} P>0, P<0	-0.27 [-0.92 , 0.37] 0.78	-0.24 [-0.94 , 0.49] 0.77	0.14 [-0.61 , 0.86] 0.64	-0.36 [-0.99 , 0.48] 0.74	-0.15 [-0.89 , 0.57] 0.61
LogK ₂₀	rg HPD _{95%} P>0, P<0	0.05 [-0.78 , 1] 0.54	-0.37 [-0.95 , 0.24] 0.85	0.80 [-0.35 , 1] 0.96	0.33 [-0.78 , 1] 0.73	-0.31 [-1 , 0.66] 0.69
A ₃₀	rg HPD _{95%} P>0, P<0	0.67 [-0.50 , 1] 0.94	0.73 [0.13 , 1] 1	-0.37 [-0.99 , 0.76] 0.83	0.49 [-0.22 , 0.92] 0.80	0.48 [-0.60 , 1] 0.81
A ₆₀	rg HPD _{95%} P>0, P<0	0.15 [-0.62, 0.96] 0.62	0.19 [-0.57 , 0.97] 0.67	0.04 [-0.78 , 0.91] 0.51	-0.10 [-0.98 , 0.71] 0.55	0.04 [-0.77 , 0.90] 0.55



		CY_{curd}	CY_{solids}	CH	REC_{Fat}	REC_{Prot}
RCT	rg HPD_{95%} P>0, P<0	-0.27 [-0.92 , 0.37] 0.78	-0.24 [-0.94 , 0.49] 0.77	0.14 [-0.61 , 0.86] 0.64	-0.36 [-0.99 , 0.48] 0.74	-0.15 [-0.89 , 0.57] 0.61
LogK₂₀	rg HPD_{95%} P>0, P<0	0.05 [-0.78 , 1] 0.54	-0.37 [-0.95 , 0.24] 0.85	0.80 [-0.35 , 1] 0.96	0.33 [-0.78 , 1] 0.73	-0.31 [-1 , 0.66] 0.69
A₃₀	rg HPD_{95%} P>0, P<0	0.67 [-0.50 , 1] 0.94	0.73 [0.13 , 1] 1	-0.37 [-0.99 , 0.76] 0.83	0.49 [-0.22 , 0.92] 0.80	0.48 [-0.60 , 1] 0.81
A₆₀	rg HPD_{95%} P>0, P<0	0.15 [-0.62, 0.96] 0.62	0.19 [-0.57 , 0.97] 0.67	0.04 [-0.78 , 0.91] 0.51	-0.10 [-0.98 , 0.71] 0.55	0.04 [-0.77 , 0.90] 0.55

Conclusions

- The magnitude of the heritability obtained for the traditional milk coagulation parameters in the Manchega breed suggests that they could be included in its breeding program.
- The RCT and A30 are strongly correlated with cheese making ability traits, which could make them as genetic selection indicators, aimed to improve Manchego cheese efficiency and quality.



Thank you



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PROYECTO PID2020-118031RR-C21: ESTUDIO DE LA VARIABILIDAD INDIVIDUAL DE LAS PROPIEDADES TECNOLÓGICAS DE LA LECHE DE OVEJA PARA SU IMPLEMENTACIÓN EN PROGRAMAS DE CRÍA
(REFERENCIA DEL PROYECTO/AEI/10.13039/501100011033)