

Milk recording in sheep and goats: state of the art and materials used for recording and sampling

J.M. Astruc¹, A. Carta², M. Simčič³, M. Špehar⁴, E. Ugarte⁵, C. Mosconi⁶ and S. Sievert⁷

¹IDELE, Castanet-Tolosan, France.

²AGRIS Sardegna, Sassari, Italy

³University of Ljubljana, Ljubljana, Slovenia

⁴Croatian Agency for Agriculture and Food, Zagreb, Croatia

⁵NEIKER, Vitoria, Spain

⁶ICAR, Utrecht, The Netherlands

⁷National DHIA USA, Red Wing, MN, USA

Corresponding Author: Jean-Michel.Astruc@idele.fr

According to the ICAR online survey, the number of dairy sheep and goats in official milk recording reached 890,000 ewes and 410,000 does in 2021. Flocks are large (200-500 females). The milking routine is fast (2-3 minutes / female) and organised by batch of 12 to 24 females milked at the same time. A video showing recording and sampling was presented during the session. Such milking systems often requires 2 or 3 technicians in the milking parlour to achieve recording and sampling activities. Moreover, due to the size of the flocks, sampling is accordingly expensive.

Abstract

Therefore, to stimulate the development of milk recording and overcome these constraints, the ICAR working group on sheep and goats has constantly promoted simplified designs of milk recording, especially of qualitative milk recording, as one of its major objectives. The recommendations are mainly based on AT or AC methods (i.e. recording of only one milking per day for both milk yield and sampling (this simplified design has consequently strongly increased over the last years to exceed 90%), the sampling of a part of the females (mostly the first parity) and only a part of the test-days (3 samples per female in the middle of the lactation are relevant for genetic purpose). However, the impact of qualitative milk recording remains low, especially in countries with large sheep and goat populations.

Devices used for recording and sampling in sheep and goats are reviewed yearly within the ICAR survey. Most of the devices used are still jars approved by ICAR with the exception status of the guidelines, as they were in use before 1995 and were accepted by the ICAR member organisations at this time. This is the case in most of the countries. Some other countries use devices indifferently in sheep and goats without actual data on precision in either of the species. Until now, there are a limited number of meters that have passed the ICAR test, probably due to difficulties to meet the requirements (low quantity of milk per test-day, high contents, and high viscosity of milk in sheep) regarding the potential market. These agreed milk meters have been moderately used so far in milk recording operations. For some of them, one reason could be the lack of suitability for sampling. Exchanging the experiences of the different stakeholders may help to stimulate the development and adaptation of milk recording and devices in small ruminants.

Keywords: dairy sheep, dairy goats, milk recording, recording devices, sampling devices, meters, jars.

Introduction

The low number of ICAR-certified milk recording devices is a difficulty that ICAR member organisations have to face in sheep and goats. Either the organisations use old-conceived materials agreed by local organisation before 1 January 1995 - mainly jars -, and benefit therefore from the exception status. Or in some cases, they use non-officially agreed materials, neither ICAR-certified, nor benefiting from the “grandfather status”.

This is why a joint session dedicated to small ruminant milk recording devices, co-organised by both the Measuring, Recording and Sampling Devices ICAR sub-committee (MRSD-SC) and the Sheep, Goats and Camelids, ICAR working group (SCG-WG), was planned in ICAR Toledo. This joint session had the ambition to tackle the challenges of milk recording in sheep and goats, (i) through presentations of the different perspectives (point of view of ICAR, the test centres, the manufacturers, and the member organisations), and (ii) through discussion with stakeholders on what we can cooperatively do to stimulate the development and testing of recording and sampling devices for sheep and goats by manufacturers.

This paper presents the point of view of the SCG-WG. We will first present a state of the art of milk recording in sheep and goats, using the yearly ICAR on-line survey (Astruc *et al.*, 2022; ICAR on-line database). We will focus on the impact of milk recording, the spread of the simplified methods of milk recording and the realisation of qualitative recording in sheep and goats. Second, we will describe the issues of recording and sampling in sheep and goats, particularly the issues related to the size of the herds and flocks and to the high speed of the milking routines. Third, we will present the specificities of small ruminant milk, and especially those of sheep milk. We will then come back to the survey to present the devices used in ICAR countries. We will finally draw in conclusion some highlights and perspectives that we consider as key features to develop material dedicated to small ruminants.

State of the art from yearly survey on sheep and goats milk recording

The terms of reference of the Sheep, Goats and Camelids Working Group (SGC-WG) of ICAR mention that it must conduct and report results of periodic surveys on sheep, goats and camelids performance recording and genetic evaluation, and (ii) maintain relationships with other groups, especially MRSD-SC.

The objective of the survey is to have a state of the art of the situation of milk recording in ICAR countries and to follow how the different recommendations of the working group, as they are suggested in the ICAR guidelines, are considered by member organisations.

Among the topics that are tackled by the ICAR on-line survey, the following are related to this paper: basic information on milk recording, methods of milk recording, optional test for milk composition, milk recording equipment.

Number of dairy sheep and goats in official milk recording in ICAR countries

When aggregating data from all the countries that have submitted data for the last 10 years, around 900,000 dairy sheep and 460,000 dairy goats are submitted to official milk recording (table 1). The majority, 86% of the dairy sheep and 88% of the dairy goats, is from the three following countries: France, Spain, and Italy. Respectively,

Table 1. Recorded dairy sheep and goats in ICAR member countries (2020-2021).

Countries	Number of recorded ewes (official milk recording)	Number of recorded goats (official milk recording)	Recording methods in dairy sheep	Recording methods in dairy goats
Croatia	7,235	3,622	AT (most) - B4	AT (most) - A4
Czech	1,494	5,152	AT	AC - E
France	334,685 (*)	227,955	AC - D	A4 – AY – AZ - CY - CZ – AT - AC
Italy	161,711	60,326	AT - AC (Sarda)	AT
Latvia		1,296		A4
Portugal	18,052	7,771	A4 (most) – AT	A4 (most) - AT
Serbia		4,846		AT
Slovak	6,643	346	AC	AC
Slovenia	4,624	2,575	AT	AT
Spain	256,480	113,934	AT – AC (Latxa-part)	A4 - AT - AC

(*) in addition, 553,836 ewes are recorded with D method (non-official milk recording)

9% and 10% of the dairy sheep and dairy goat populations are recorded (official milk recording). In addition to official milk recording, France has 550,000 dairy sheep in D method. There is a relative stability of recorded animals over time.

The table 1 shows the different methods used. The simplified methods (those with one recorded milking per day) have been highly recommended by the SGC-WG for many years. The simplified methods used in sheep and goats are AT, AC, AY, AZ, CY, CZ, while the non-simplified (two recorded milking per day) methods are A4, B4, E (ICAR guidelines – section 16). We estimate that simplified designs concern 98% of the recorded dairy sheep and 58% of the recorded dairy goats. The D method (non-official design) is used in France in commercial flocks (sheep). Simplified milk recording methods are more used in sheep than in goats.

Importance of simplified recording methods

Qualitative recording is globally generalised in goats. In dairy sheep, in countries with large population size (Spain, Italy, France), qualitative recording is partial, while in countries with smaller population size, qualitative recording is generalised.

Use of qualitative recording (optional recording)

The spread of simplified designs of milk recording (quite generalised in sheep and majority in goats) and the limitation of qualitative recording to a part of the animals (especially in large populations of dairy sheep) may be explained by two main reasons. First, the large flocks/herds size (300-500 animals) makes milk recording more expensive because of the cost of many milk analyses. Second, the high speed of the

The issues of recording and sampling in sheep and goats

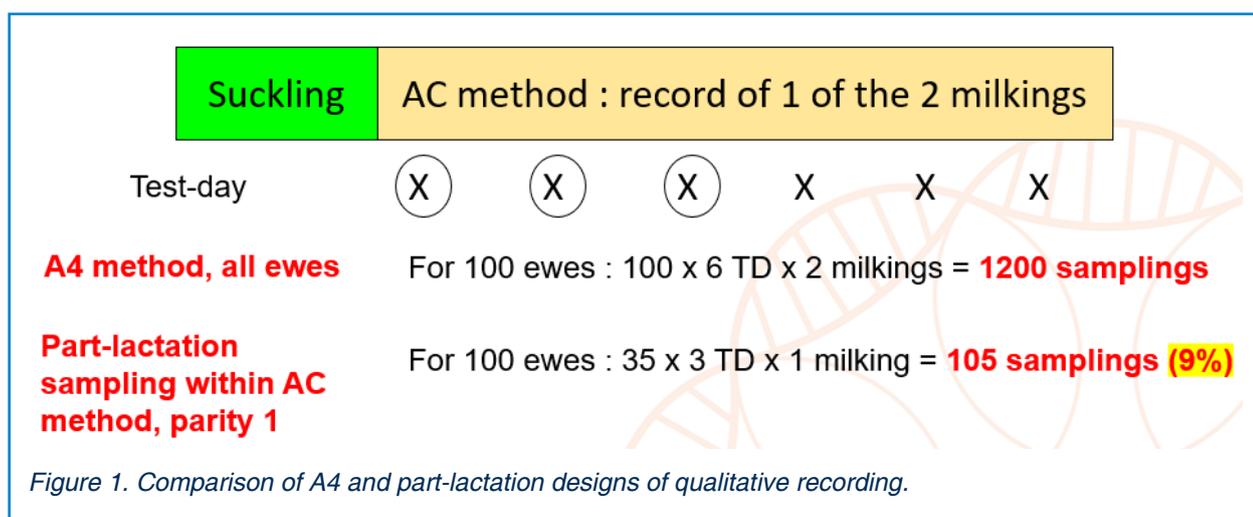
milking routine (1 sampling every 15-20 seconds) requires more often one or more additional technician(s) to realise the sampling.

It is therefore necessary to rationalise and to think the milk recording designs in terms of cost-benefit for the breeding program efficiency.

There are three ways to simplify the qualitative milk recording. First, qualitative recording is an optional disposition in the guidelines. That is why some breeds do not realise sampling. However, as soon as a breeding program is efficient on milk yield, it becomes necessary to include fat and protein contents information in the selection criteria. When qualitative recording is necessary, it is recommended to reduce the part of the animals sampled within the farm. For example, only the ewes/does in parity 1 (or parities 1 and 2) may be sampled. As a third strategy to rationalise qualitative recording, it is possible to use the part-lactation sampling method. This design consists in sampling only the middle of the lactation, which is the part of the lactation with the highest genetic relevance (the most heritable and the most highly correlated with the whole lactation). This method allows to reduce by half the number of samples. It is implemented in dairy sheep, in France, Italy and Spain. Such simplifications imply an acceptable decrease in the accuracy of the EBVs, compared to the gain in cost.

The figure 1 gives an illustration of the interest of the part-lactation sampling applied to the AC method in terms of number of analyses. Milk recording is realised on one milking only, 3 test-days (TD) out of 6 are sampled, and the sampling is applied to the first parity only. In the A4 methods (considered as the reference), 1,200 samplings are done for 100 females (100 females x 6 TD x 2 milkings). In comparison, in the described simplified design, 105 samplings are done for the same 100 females (100 females x 3 TD x 1 milking x 35% in parity 1). This means a decrease in 91% of the number of samplings.

We must have in mind the consequences of such simplified designs. As few samples are realised, there are few measures of content in an animal lifetime (between 2 and 6 measures). Such a decrease in number of measures leads to a decrease in the heritability, especially the heritability of fat content (from 0.50 to 0.35 in the case of France). Genetic progress depends on the accuracy of the EBVs. Yet it is economically unthinkable (on large populations) to increase the number of measures to compensate this lower heritability. Therefore, each measure must be precise enough. Relaxing the precision of an individual measure would lead to a lower efficiency of the selection, which is obviously not expected from the geneticist point of view. This highlights the



fact that the devices must be accurate, and sampling must be accurately representative of the milking.

However, small ruminant milk (and especially sheep milk) has “unfavourable” specificities regarding the recording and sampling devices.

If milk contents in goats are quite similar to those in dairy cattle, sheep milk components are high. Fat content is on average 70-75 g/l (up to 130-140 g/l in late lactation stages). Protein content is on average 50-55 g/l (up to 100-110 g/l in late lactation stages). Sheep milk has a high viscosity and there is a lot of foam (Figure 2). In addition, in sheep and goats, the quantity of milk per milking is small (500 ml – 4000 ml) rendering the sampling is more difficult.

Specificity of small ruminant milk

All these characteristics make the recording of yield, and above all the sampling, more difficult to realise with accuracy. To try to overcome these difficulties, requirements in the ICAR guidelines (ICAR guidelines – section 11) have been relaxed for sheep and goats over the last 20 years, by adapting the limits of error. The last changes were accepted in 2023. For milk yield, the limit of error for bias is 1.5 time higher in sheep and goats compared to cattle. For fat percentage, the limit of error for bias is twice higher in sheep and goats than in cattle, and the limit of error for standard deviation is 3 times and twice higher, respectively in sheep and goats than in cattle.

Despite these relaxed requirements, few materials have been tested by ICAR. To date, the materials certified by ICAR are the MM25SG from DeLaval (low line) in sheep and goats, the Lactocorder from WMB (high line) in sheep and goats, the ARG1 jars from Sarl ELCABE (high line) in sheep and goats. The Afifree from Afikim is no longer sold.



Figure 2. Foam above the milk in a jar during a milk recording in a Lacaune flock in southern France.

Table 2. Recording and sampling devices used in dairy sheep and goats in ICAR member countries (2020-2021).

Countries	Goats		Sheep	
	(Portable) Jars	Meters	(Portable) Jars	Meters
Croatia		Waikato MK4		Waikato MK4
Czech		Tru-Test (Mini)		Tru-Test (Mini)
France		Tru-Test (50%) Lactocorder WMB (50%) Few DeLaval MM25SG(<5)	Gély (~3,000)	Lactocorder WMB (<5), MM25SG(<5)
Italy	MIBO, Miele, Italiana, ROYAL (1/3)	Waikato MKV (1/3), Tru-Test HI, EMM (5%) [Lactocorder WMB, DeLaval MM25SG]	MIBO, ROYAL (90%)	Waikato MKV, EMM (5%) [Lactocorder WMB, Afifree, DeLaval MM25SG]
Portugal	Westfalia, Vitlab	Sneder Mayfra, Tru-Test		Tru-Test, Flaco
Slovak	Fisher Slovakia,	Tru-Test	Fisher Slovakia, Berango / Milkovis	
Slovenia		Waikato MK4, Tru-Test		Waikato MK4, Tru-Test
Spain	Esneider	Tru-Test, DeLaval	Berango (model Esneider) MIBO (model Lattometri) Gruponor	DeLaval MM25SG, Westfalia, Afikim, Flaco, GEA

EMM = (on-farm) Electronic Milk Meter.

The devices used for milk recording and sampling in sheep and goats

According to the yearly on-line survey, the devices used for the milk recording operations in dairy sheep and goats are displayed in the table 2.

A major part of the devices used are portable jars, particularly in sheep, approved through the exception status (as they were approved by the ICAR member organisations before 1 January 1995). There are still few on-farm electronic milk meters used for milk recording operations, except in some breeds in Spain. The ICAR certified devices are not widespread, except for the Lactocorder in goats in France (around 50% of the recording operations) and the MM25SG in Spain.

Conclusion and perspectives

As the sizes of the herds and flocks are large and as the speed of the milking routine is high, the development of milk recording in such large populations of sheep and goats is possible with simplified recording designs. Sampling operation is a key concern for expanding milk recording in sheep and goats. Sampling devices must be friendly and allow a fast pace that does not exceed 20 seconds. Getting good accuracy in recording yield and sampling milk is a challenge for the devices, especially in sheep for which milk quantity is low and fat content is twice as high as in cattle. ICAR has adapted its guidelines to sheep and goats, by relaxing the limits of accuracy, and by separating sheep and goats. Despite that, most of the devices used are jars “agreed” through

the exception status. New requirements, voted by the ICAR General Assembly in Toledo in 2023 (ICAR guidelines – section 11) might help manufacturers to produce new materials for sheep and goats. The key factor to stimulate the market is to have friendly sampling devices.

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<https://www.icar.org/Guidelines/11-Milk-Recording-Devices.pdf>

ICAR guidelines – Section 16 Dairy Sheep and Goats.
<https://www.icar.org/Guidelines/16-Dairy-Sheep-and-Goats.pdf>

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<https://my.icar.org/>

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