Wool recording in sheep: results from an ICAR on-line survey

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Abstract

The ICAR Sheep, Goats and Camelids Working Group based on the interests of breeders' organisations has decided to include wool performance recording in its guidelines. Therefore, the Working Group has established an Expert Advisory Group with the objectives to determine the traits of interest, their collection and genetic evaluation. In order to achieve these objectives, representatives of breeding organisations and other relevant institutions responsible for sheep recording were asked to fill out an on-line survey on sheep wool. The survey includes basic information such as contact details of the organisations and specific questions regarding the wool population. The latter includes information's of the breeds involved, the size of the recorded and non-recorded population, the number of farms with wool records, information about traits recorded, phenotyping methods and protocols, genetic evaluation, and selection indices. Additional relevant data on management of animals (e.g., shearing) were also collected in the survey. Altogether, seventeen breeding organisations responded to the on-line survey. The number of animals included in the wool recording by country ranged from 200 to 2,900,000. As expected, the most common breed in wool recording was Merino, followed by Dohne Merino and local breeds. The traits involved were fleece weight, clean fleece weight or yield, fibre diameter, fibre diameter variation, staple length, staple strength, homogeneity of fleece, fibre density, fibre curvature, colour, visual appreciation, and additional traits. The most frequently recorded phenotypes were fibre diameter, staple length, fleece weight, fibre diameter variation, visual appreciation, and colour. The survey results provided useful insight into wool recording and will form the basis for guidelines development.

Keywords: sheep, wool recording, on-line survey, traits, genetic evaluation

Introduction

The ICAR Sheep, Goats and Camelids Working Group (abbreviated SGC WG) has developed the guidelines and standards for performance recording in dairy sheep and goats and the guidelines for performance recording of growth, meat, reproduction and maternal ability in sheep and goats. To date, wool traits have not been included in the ICAR guidelines, although wool production is an important sector of genetic

improvement and performance recording internationally. Contrary to countries that keep mainly dairy or meat sheep and goats (such as most European countries), the cost of sheep shearing is higher than the value of the wool, which means a financial loss for the breeder. Due to the increasing demand for recommendations on wool, ICAR has set itself the goal of expanding its guidelines to include the traits related to wool. For that purpose, an Expert Advisory Group was established to define the list of wool traits of interest, the methods of their recording, collecting, measuring, assessing, and to propose the method and statistical models for genetic evaluation. To achieve these objectives, an on-line survey on wool recording has been created. Relevant institutions were invited to complete the on-survey during the years 2020 and 2021 in order to collect the relevant information worldwide. The aim of this paper was to provide an overview of the feedback from the on-survey that will form the basis for recommendations on wool recording and genetic improvement of wool traits.

Material and methods

Breeding organisations and other relevant institutions responsible for sheep recording were invited to fill out an on-line survey about sheep wool. The survey includes basic information about the breeding organisations (name, country, and contact details for the organisation's representative) and specific questions regarding the wool population size (total sheep population size, wool sheep population size and number of farms with wool performance recording), information regarding wool breeds – the main breed and additional breeds if they are included in wool recording (total population size, population in wool performance recording, and number of farms with wool performance recording), and relevant information about recorded wool traits. The following list of wool traits has been proposed for recording: fleece weight, clean fleece weight or yield, fibre diameter, fibre diameter variation, staple length, staple strength, homogeneity of fleece, fibre density, fibre curvature, colour, other additional traits (such as different kind of visual appreciation), and traits requiring a sample of wool. For the latter, the protocol of sampling were requested. The following information's for traits have been collected from the survey: recording of the trait (yes/no), who collects the data, method of collecting, device for measuring, unit of trait expression, recording age of the animals, minimal/optimal wool growth period, assessment (subjective or measured), information's about genetic evaluation of the trait (genetic parameters, evaluation method and statistical models, inclusion of the trait in the economic index). Additional relevant data on management of animals (e.g., shearing) were also collected in the survey.

The SAS statistical package (SAS Inst. Inc., 2009) was used to analyse the data and generate descriptive statistics.

Results and discussion

In total, 17 relevant institutions on wool recording from 14 countries responded to the on-line survey (Table 1). Most of institutions (10 of them) answered the survey completely, while seven institutions completed partial survey.

As expected, the largest wool population is coming from Australia, followed by New Zealand and South Africa (Table 2). Only a small proportion of these populations (between 0.09 and 4%) are under wool performance recording. However, these countries have respectable number of farms with performance recording for wool. On the other hand, the entire wool population of Portugal is involved in the performance recording with a certain number of farms.

Table 1. Survey status by country (and breeding organisation).

Country	Status of survey	
	Fully completed	Partially completed
Australia		1
Austria		1
Bulgaria		1
Croatia		1
Czech Republic	1	
Finland	1	
Iceland	1	
Latvia	1	
New Zealand	1	1
Portugal	1	1
Slovenia	1	
South Africa	2	
Sweden		1
Uruguay	1	
All	10	7

Table 2. Total size of the wool sheep population, population size, number (N) of wool performance-recorded ewes (WPR), proportion (%) of population in WPR and number of farms (no.) in WPR.

Country	Total size	N in WPR[1]	% in WPR	No of farms in WPR
Australia	70,000,000	2,900,000	4	222
Bulgaria	10	2	20	1
Croatia	42,000	200	0.47	1
Finland	14,170	1,000	7	10
Latvia	28,224	5,448	19	49
New Zealand	27,600,000	20,000	0.7	35
Portugal	26,232	26,232	100	90
Slovenia	5,452	150	2.7	2
South Africa	24,000,000	626,000	3	589
South Africa	15,000,000	13,550	0.09	65
Uruguay	6,723,548	25,500	0.4	81

[1]WPR = wool performance recording

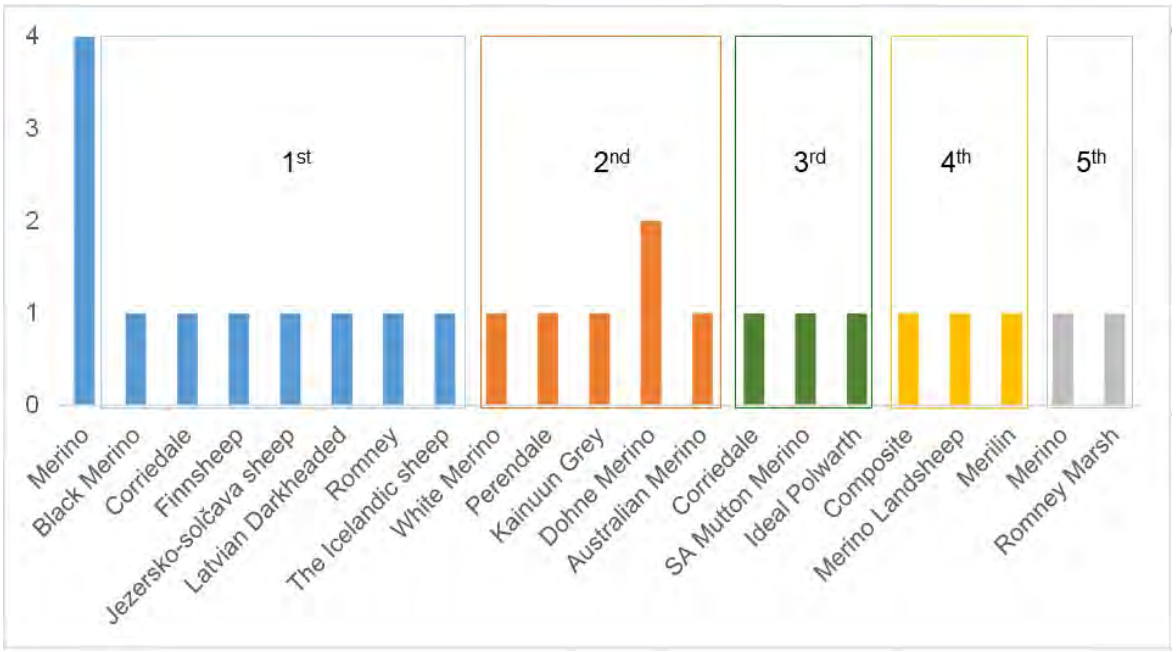

Figure 1. Frequency distribution of common breeds under wool performance recording.

The next part of the survey was related to the breeds having wool performance recording (Figure 1) and 11 of the 17 breeding organisations responded. As expected, the most common main breed was Merino (36%) followed by Dohne Merino and local breeds. There was also a possibility to include additional breeds in the survey (from second to fifth breed). Besides specialised wool breeds, some of them belong to the group of mountain and lowland breeds. Both, males and females were included in the wool sample collection.

The most common traits for wool performance recording are reported to be fibre diameter, staple length, and fleece weight (Figure 2). Beside these, fibre diameter variation, visual appreciation, and colour have been traits frequently used in wool recording. Less frequent traits were staple strength, fibre density and homogeneity. Beside these traits, organisations have the opportunity to provide information about additional traits if they were recorded but not included in the given list (five responses). On-line survey also offered the possibility to provide information about traits that require a wool sample (seven responses).

Respondents were asked about the person who collecting the data, the method and the device used for measuring, and the units of trait expression. The results regarding data collection are summarised in Figure 3. The farmer was most common person involved in data collection, followed by technicians and laboratory staff. Experts were involved in the collecting specific traits such as visual appreciation. For traits requiring practical knowledge (e.g., fibre curvature, staple strength, fibre density, and homogeneity), data collection was performed by technicians.

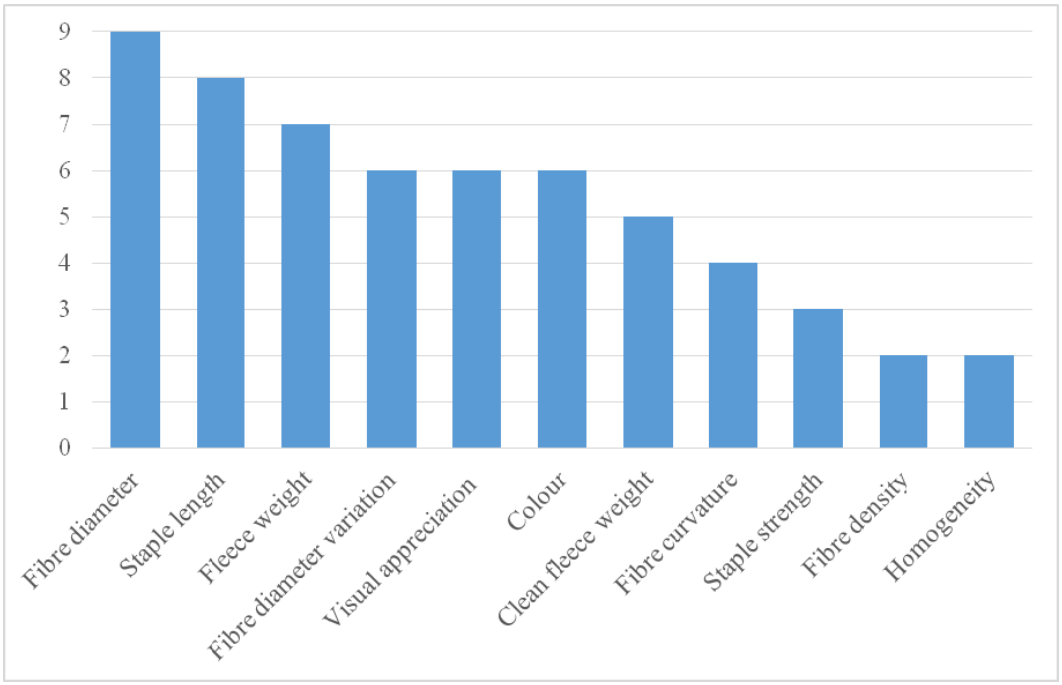

Figure 2. Frequency distribution of traits involved in the wool performance recording.

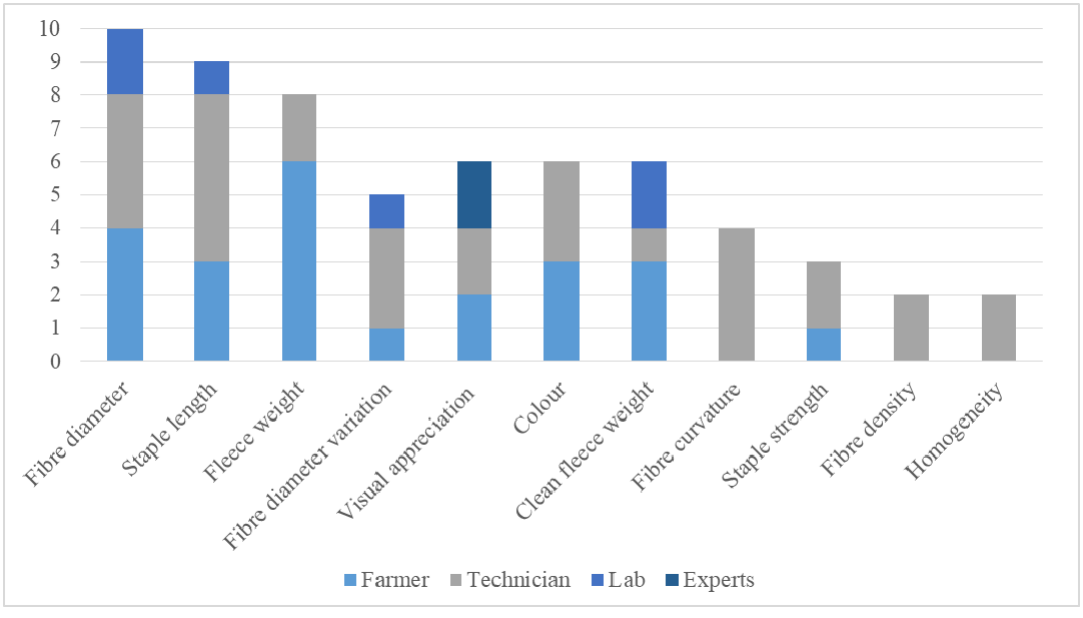

Figure 3. Persons responsible for data collecting by trait.

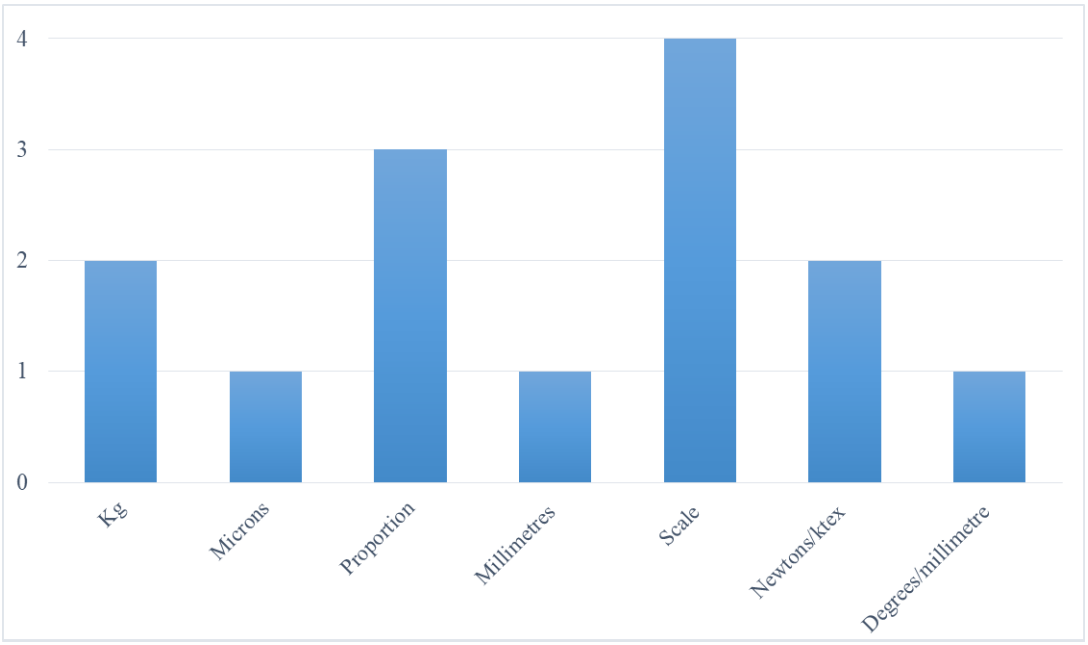

Figure 4. Unit of trait expression.

Methods used for recording wool are trait related. According to the respondents, some traits are weighed (fleece weight, clean fleece weight), others are either visually recorded (colour, fibre density, homogeneity), scored by scale (visual appreciation), tested with different methods (atlas or pull test have been used for staple strength recording), or measured with special machines, instruments and devices (fibre diameter, fibre diameter variation, staple length, and fibre curvature). In the case when traits are weighed or measured, the equipment used for this purpose was also specified. The units for trait expression (Figure 4) were either kg (fleece weight, clean fleece weight), microns (fibre diameter), proportions (clean fleece weight, fibre diameter variation), millimetres (staple length), Newtons/ktex (staple strength), scale (homogeneity, fibre density, colour, visual appreciation), and degrees/millimetre (fibre curvature).

Results regarding recording age and minimal/optimal growth period showed wide variation depending on trait, breed, and country. Recording age ranged from three (fibre curvature) to 28 months (fleece weight and clean fleece weight), while growth period ranged from three (fleece weight, fibre diameter) to 18 months (visual appreciation).

The last part of the survey included information regarding genetic evaluation. In most of the responding organisations, breeding values for wool traits have been estimated (Figure 5). The exceptions are fibre density and homogeneity. BLUP animal model as computation method was considered as being the standard for the genetic evaluations. In addition, the BLUP method has been extended to GBLUP by including molecular data for genomic evaluation of wool traits in Australia. Proposed traits have been mostly included in the economic index. The survey also included additional information on traits such as average phenotype, annual genetic trend, and genetic parameters (genetic variance and heritabilities) to provide an overview of how heritable these traits are.

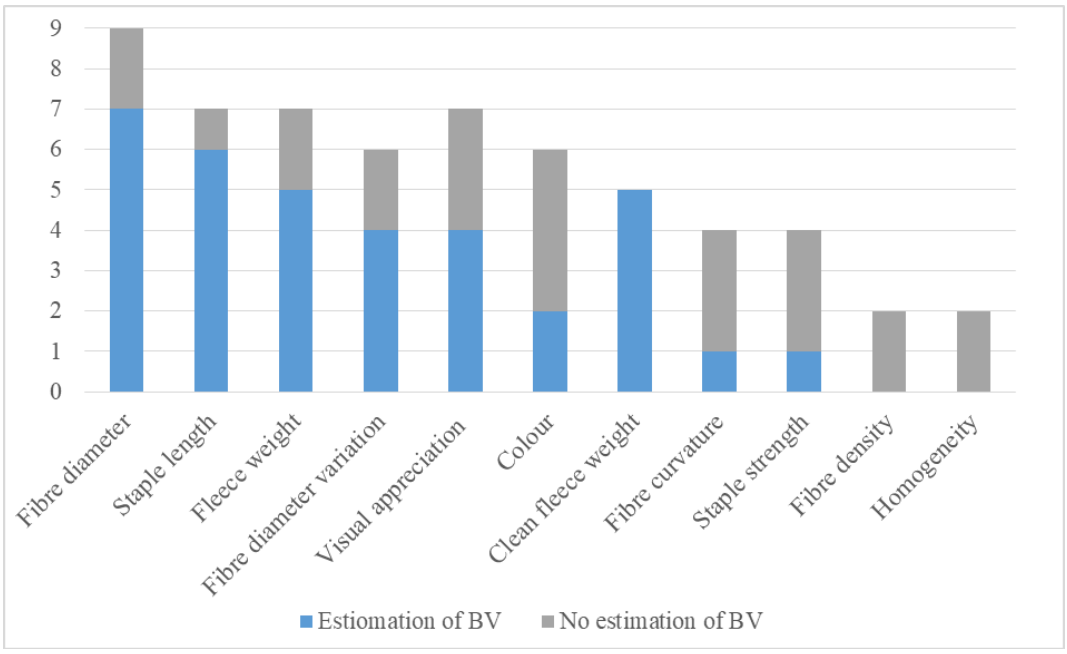

Figure 5. Estimation of breeding value by trait.

Additional relevant data on management of animals (e.g., shearing) were also collected in the survey. Responses indicate that animals are shared once or twice a year, usually in the spring and autumn. The final element of the survey, an open textbox option allowed for qualitative feedback that would be useful for completeness of the survey. Most respondents chose to tell more about their breeds and related issues.

Conclusion

The results from the on-line survey offer useful insight in wool recording and provide some general considerations, common traits that could be collected and recommendations for wool performance recording. They also provide information about genetic evaluation as a tool for genetic improvement of wool production traits. Furthermore, the survey results will serve as a basis for developing new ICAR guidelines for recording wool traits in sheep.

References

SAS Inst. Inc. 2009. SAS/STAT® 9.2 User's Guide, Cary, NC: SAS Institute Inc