Small Ruminant Research 150 (2017) 60–69

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Sources of variation in fibre production and quality traits source of variation in down-bearing Patagonian goats and implications for developing a cashmere industry

E.N. Frank[a,b,*], M.V.H. Hick[a,b], D. Russano[a], M.F. Castillo[a], A. Prieto[a], E.G. Aisen[c]

[a] Programa SUPPRAD, Unidad Asociada—Universidad Católica de Cordoba—CONICET, Córdoba, Argentina
[b] Sede Universitaria Chamical (UCHA), Universidad Nacional de La Rioja, Chamical, La Rioja, Argentina
[c] Universidad Nacional del Comahue, Laboratorio de Teriogenología, Cinco Saltos, Rio Negro, Argentina

ARTICLE INFO

Article history:
Received 23 March 2016
Received in revised form 13 February 2017
Accepted 6 March 2017
Available online 11 March 2017

Keywords:
Patagonian cashmere
Fleece type
Fineness
Crimping
Quality fibre

ABSTRACT

Even though mohair production in Argentina is well known, data about fibre production from double-coated regional native goats—generically referred to as Patagonian Cashmere-remains scarce. The aim of this paper was to determine the production of down fibres and to assess the quality and variability of the fleece characteristics of the Northern Patagonian Creole goats. From late winter to early spring of 2005–2008, 2397 fibre samples were collected from five areas of NW Neuquén in Northern Patagonia. The average of down fibre diameter (DFD), down fibre length (DFL), down weights (DW) yields to dehairing (Y%), ratio of coarse fibre length (CFL) on down fibre length (DFL) (R:CFL/DFL), crimp/cm and the degree of curvature (C°) of the fibre were measured. For DFD an average of 20.4 ± 3.6 μm, DFL of 7.9 ± 3.2 cm and C° of 38.1 ± 5.8°/mm, a Y% of 32.5 ± 13.9% and a DW of 255.7 ± 66.0 g were obtained. In an attempt to reduce the variability of the fibre variables studied, locality, herds, age, fleece types and fineness were included as external effects in ANOVA. All the variables measured were greatly affected by style: long cashmere (LC) was the most frequent style (41.5%) followed by cashgora (CG) (22.2%). The most common grade of fineness (57.5%) was >19.0 μm, indicating that 42.5% of the fibre was below 19 μm in DFD. The other variables were significantly different within LC, short cashmere (SC) and intermediate cashmere (IC) styles when the grade of fineness was compared. The styles with lustre effect (CG and L) showed very low crimp as compared to the other styles. Taking styles as numerical, a Spearman's rank correlation coefficient (r_s) was calculated with numerical grade of fineness (r_s = 0.45), DFD (r_s = 0.58), DFL (r_s = 0.56) Y% (r_s = 0.61), R: CFL/DFL (r_s = −0.60); DW (r_s = 0.56); C°/mm (r_s = −0.27). It was concluded that the classification by styles and fineness could determine more than 42% of fleece complies with the cashmere textile industry requirements.

1. Introduction

Cashmere is the fibre most strongly associated with luxury and the one that has maintained the greatest mystique about its origins, production and processing. It is obtained from a double-coated animal, and there is no such thing as a pure cashmere goat (Hopkins, 1991; Moylan and McGregor, 1991).

This fibre has traditionally been grown in China, Mongolia, Iran and Afghanistan, and it is used for both knitting and weaving, and the Iranian fibre is generally shorter, coarser and more crimped than other sources. Regarding the cashmere produced in Australia and New Zealand, it is very lustrous, coarse and long, and it is generally used in the weaving industry (McGregor, 2014). Cashmere from Australia and New Zealand, the USA, Argentina and the U.K., is non-traditional, and is less known by processors and consumers. The finished product is also "non-traditional cashmere" and hence only viable market is blended with other cashmeres or wool for the weaving industry at prices comparable to Iranian cashmere (Hopkins, 1991).

Cashgora, on the other hand, is the fibre produced by cross-breeding an Angora with a cashmere or another type of goat. In fact, this is a myth as cashgora has been creeping into much of Iranian and Mongolian cashmere clips for years (Hopkins, 1991). In Australia and New Zealand, in an effort to improve down weight, several cross breeding programs were developed, and cashgora is

* Corresponding author at: IRNASUS-Universidad Católica de Córdoba-CONICET, Argentina. Tel.: +54 351 493 8030; fax: +54 351 493 8031.
E-mail address: frank.agro@ucc.edu.ar (E.N. Frank).

http://dx.doi.org/10.1016/j.smallrumres.2017.03.003
0921-4488/

the result of one of such attempt (Moylan and McGregor, 1991; McGregor, 2000). In Argentina, a similar situation occurred when trying to upgrade the hairy Creole goat by crossing it with Angora sires (Lanari et al., 2003).

Some earlier studies have shown that the Creole goat fibre from the Northern Patagonia behaves similarly to the Iranian cashmere (Maurino et al., 2008). But, Ansari-Renani et al. (2012) showed that it was coarser and longer than Chinese and Mongolian cashmere. This finding has been confirmed by other research works as well (McGregor, 2007).

In Australia, with the local goat population crossed with Angora goats (Faure Island), fleece sorting allowed to separate long cashmere from other inferior quality types (McGregor, 1997). Based on the observation of the fine fibre crimp, it was classified in 5 different Styles or Fleece Types. The use of the degree of curvature as a tool in the selection or classification of homogeneous intraherd batches of fibre for sale provides effective results. This is similar to the treatment received by mohair (McGregor and Butler, 2004) and Llama fibre in Argentina (Frank et al., 2007).

In the case of the Patagonian fibre, a similar situation to that of the Australian goat exits, due to the frequently undetermined cross with Angora goats. In addition to the crimp and the coarse/fine fibre length ratio, details of the flat locks associated with Mohair are also included (Simmonds, 2000).

As regards Texas cashmere goats, a method for predicting the styles is analysed and validated with OFDA measurement, using a quantitative scale based on the quality of the crimp definition. The scale ranges from 1 (excellent style) to 5 (deficient style) (Lupton et al., 1999).

Anyway, the classification of the collected cashmere lots does not require high precision of each fleece grade. During trading and subsequent industrialization, focus is on the lot mean, for which batches of up to 16.5 μm (H) and between 16.6 and 19 μm (W) are required (Anonnymus, 2010). Outside this arbitrary limit, there is a significant amounts of fibre that are not referred to as cashmere, and which may receive different names in different countries, such as Middle Micron (19–22 μm), Strong Cashmere or Cashgora when it also presents 3 types of fibres (down, intermediate or heterotype and guard hair) due to its similarity with mohair (McGregor, 1997; McGregor et al., 2011). Some sorting systems should allow to reduce variability in the fibre production attributes of this caprine population.

Even though fibre production from Angora goat (Mohair) is well known in Argentina, data about fibre production from the double coated regional native goat – generically referred to as Patagonian Cashmere – remains scarce.

Anecdotal information obtained confirms that shearing and commercialization of fibre from these goats dates back as far as 30 years ago. Its price was very low to make it particularly attractive for the transhumant growers in the region, and probably this explains why shearing practice is no longer widespread today.

This goat population presents a wide variability in features of fibre production. Several studies have tried to elucidate the origin of this population, yet they have not been able to shed light on this respect from a genetic viewpoint, though an Asian origin is suspected (Lanari et al., 2003). As regards the fibre, it is characterized by a wide variety of fleece types, and low frequency of colours given the fact that most of the animals are white. In general, the characteristics of fibre quality (diameter, length and yield) also vary (Hick et al., 2006).

This population consists of close to 500,000 goats with these characteristics, and it is found in a border zone: West of La Pampa, South of Mendoza, Northwest and North of Neuquén, and Northwest of Río Negro, which would indicate a continuity between the different herds located in these provinces.

More than 50% of these goats are transhumant animals with good meat production properties, the production of kids meat (capreto) being the current major product.

In 2002, a local dehairing technology to remove coarse fibres from mixed fleeces, proved to be essential for the subsequent use of these fibres in the textile industry (Hick et al., 2003; Frank et al., 2009a). Based on the first positive results obtained with the dehairing technology, population structure studies were conducted in one locality in La Pampa province (Hick et al., 2006), 6 localities in Neuquén province (Frank et al., 2008) and another locality also in Neuquén (Frank et al., 2009b). These studies established the quality of fibre produced by these populations and their potential industrialization in the country provided the wide variability reduced by classification or sorting system.

The objective of this work was to determine the production of down fibres, and to assess the quality and variability of the fleece characteristics of the Northern Patagonian Creole goats, as a prelude to developing a sorting system and contribution to marketing strategies for the development of the Patagonian cashmere industry.

2. Materials and methods

2.1. Study area and experimental goats

The study encompassed different stages that originally included locations of Minas, Ñorquin, Chos Malal, Pehuenches and Añelo departments, situated to the North West of Neuquén province. In these areas (between 36° and 39° Lat. S. and between 68° and 71° Long. W), the methodology known as Population Structure was used for data collection. This methodology includes a system of surveys and sampling where the choice of the sampling herds by the non-probabilistic sampling technique called 'snowball' was used, and the random sampling of at least 30% of adult animals from the herd was carried out (Hick and Frank, 2013).

2.2. Sources of samples

From late winter to early spring 2005–2008 in Northern Patagonia, Neuquén province, 2397 fibre samples were collected from 2223 does (adult females), 90 adult males and 84 castrates The samples came from the following areas: 0: Guañacos; 1: Las Ovejas; 2 Varvarco; 3: Barrancas and Buta Ranquil, and 4, 5 belong to NW Añelo and SW Añelo, respectively, which correspond to the areas classified as MÑ (0, 1 and 2); B (3); P (4) and A (5) by Lanari et al. (2003).

One third of all farms in each area were sampled to account, for geographical spread, in each Area and distance from main towns. The trained collectors randomly selected goats of at least 1 year of age with different coat colours from each flock, based on the available penned goats. A total of 37 farmers from the 6 areas provided 10,490 goats for the 2397 samples. Samples of full fleece (guard hair and cashmere) were taken from the mid-side by cutting the fibre from a 3.1 cm × 3.1 cm square at skin level. Samples were stored in sealed identified plastic bags. The age, sex morphotype, colour and girth circumference of the goats were registered by the collector. The age was estimated based on incisor dentition, along with recorded details of the area and farmer. Sampling (May–Aug) was timed to coincide with the maximum cashmere growth prior to the seasonal moult. This was verified a minimal growth of the fibre (possible onset of molting) at the end of winter and early spring (Lanari et al., 2008). The body condition score of sampled animals was approximately 1.8 points, indicating poor feeding levels, with no differences among locations.

The total fibre weights were estimated as follows: $TFW = 134 \times LW^{0.703} \times$ patch down weight (g) (Bishop and Russel, 1994). Liveweight (LW) was estimated from a multiple regression equation from girth circumference (GC), animal age and sex: LW = −61.49 + 0.94 (GC) + 0.25 (Age) + 5.55 (Sex) (Prieto et al., 2012).

2.3. Fibre analyses

In the laboratory, samples were scoured and prepared. Several measurements were carried out on the fibre sample, total fibre weight and weight of the down.

From each individual sample, three random staples were drawn. From each staple, the longest cashmere fibre and guard hair were drawn. The fibres were gently drawn straight on a velvet board, sorted by length and measured to the nearest mm.

From each sample, staples were chosen and dissected to draw Baer diagrams, identify and classify types of fibres, measure fibre length, and weigh each fibre type. Fibre types were classified on the basis of the type of crimp, and the ratio length of coarse to fine fibres as in Frank et al. (2009b). They were classified into type of fleece (style) relative to morphology as: Long Cashmere (LC), Short Cashmere (SC), Intermediate Cashmere (IC), Cashgora (CG), and Lustre or Mohair (L) based on the description given in Table 1.