STUDIES ON BREEDING METHOD IN HIGH QUALITY NEI MONGOL CASHMERE GOAT

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INTRODUCTION

Cashmere goat production is widespread in the world. Nei Mongol (NM) Cashmere Goat becomes a major breed of high quality cashmere production in the world. NM is located in northern China, a narrow belt, stretching more than 5000 kilometers from east to west. Vegetation changes drastically in different seasons and regions, and also decrease in the species and numbers from east to west. There are 13 million cashmere goats in total in NM, which amount to 21.67% of numbers of down-bearing goats in all China. Annual production of cashmere is more than 3831 tons, which amount to 39.30% of total yields of down hair in all China. There are 8200 cashmere goats, including 3400 kernel goats, in Inner Mongolia Albas cashmere goat breeding farm (latitude 39°. 06' N, longitude107°59'E, sea level 1380.3m), which is located in southwestern NM. To our knowledge, increasing cashmere yield without deteriorating cashmere quality is one of the major goals for NM cashmere goat breeders; few studies have been conducted on systematical breeding in NM Cashmere Goats until 1996.The aims of this research were to investigate the genetic variability and relationship, and to make the breeding methods of cashmere goat becoming more and more perfect by using animal model BLUP in this field. We also want a better understanding of the genetic control of cashmere goats from birth to culling in China. The specific objective was to design breeding method for genetic evaluation in order to introduce appropriate method into a breeding scheme for genetic improvement of cashmere goats.

MATERIAL AND METHODS

Flock management. The study was undertaken in the Albas Cashmere Goat flock of NM from 1996 to now. Traditionally, the animals were kept extensively in a desert pasture all the year through. The composition of vegetation is usual forage for goats, and only goats graze some of them. All animals were individually identified, the pedigree was well known, identification number, date of birth, type of birth (litter size), sex, birth weight, sire and dam, age of dam, weaning weight, date of combing, cashmere yield, body weight at the harvest of down hair were recorded. Weaning of kids were generally performed at the age of 4-5 months. The bucks were semi-housed and supplemented only in the seasons of mating for collection of semen. Reproductive activities lasted approximately 60-90 days (from September to November) for oestrus and mating, and three months (from March to May) for parturition.

Selection and mating. Goats were selected on an index that gave economical weights to body weight and cashmere yield according to the following formula: $H=W_1a_1+W_2a_2$, where a_1 and a_2 are breeding value of cashmere yield and body weight, W_1 and W_2 are economic benefits of the

two traits. Selection for litter size using independent cull method also. Mating was like to like and planned to keep inbreeding as low as possible in the flock. These works were done using Cashmere-goat Appraisal Mating Service program designed by our team.

Statistical analysis. At weaning, all kids born were available for analysis at beginning of generation. During harvesting down hair, all goats were involved in the research. Two interest traits considered in the study are cashmere yield and body weight on the basis of breeding goal and the actual conditions of NM Cashmere goat breeding farm. The fixed effects were tested by GLM model using SAS software. Variance and covariance components for genetic and residual effects were estimated by animal models using MTDFREML software package according to the following models: Y=Xh+Bg+Za+Wp+e, where Y is the vector of observations, h is the vector of herd-year-sex fixed effects, g is the vector of age fixed effects, a is the vector of random direct additive genetic effects, p is the vector of random individual permanent effects, e is the vector of random residual effects. X, B, Z and W are the incidence matrixes connecting Y to the effects in the model.

RESULTS AND DISCUSSION

Description of phenotype. Six interest traits: cashmere yield, deepth of cashmere, length of staple, body weight, length of cashmere and diameter of cashmere were investigated at the very beginning of the study. Regular patterns of the interest traits of Nei Mongol cashmere goat by age are shown in Table 1.

Table1. Phenotype values of interest traits by age (means along with their standard deviation)

Age	Number of goats	Cashmere yield (g)	Depth of cashmere (cm)	Length of wool (cm)	Body Weight (kg)	Length of cashmere (cm)	Diameter of cashmere (um)
1	2118	457±94	5.04±0.84	15.40±3.93	20.60±2.09	9.36±0.64	13.10±0.52
2	1516	574±146	5.63±0.91	16.88±3.73	27.18±2.86	10.02±0.72	13.92±0.60
3	1270	551±125	5.44±0.76	17.13±3.72	29.54±3.01	8.85±0.88	14.72±0.70
4	973	568±123	5.57±0.78	16.97±3.79	31.58±3.32	8.96±1.10	14.77±0.68
5	660	559±121	5.58±0.78	16.69±3.79	33.04±3.78	8.75±0.98	14.64±0.53
6	406	554±131	5.58±0.78	16.69±3.70	33.32±3.81	8.74±1.14	14.56±0.75
7	195	536±122	5.29±0.73	17.13±3.36	34.34±3.40	8.41±1.18	14.74±0.48

Genetic parameters. Summary of genetic parameters of six interest traits listed above in the Nei Mongol Cashmere Goat is given in Table 2.

Genetic trends. Genetic trends were evaluated based on bucks weighted average breeding values in cashmere yield and body weight during 1989-2000 (Fig 1). The results showed that genetic trend exhibited a rising for cashmere yield and smooth for body weight. The study indicated that selecting cashmere goats based on commonly used breeding method had a low accuracy, and it was difficult to give consideration to the two traits at the same times. The animal model BLUP method should be used to select cashmere goats in future.

Table 2. Summary of genetic parameters for six traits.

Name	Heritablity	Repeat Ability	Genetic correlation				
			Body weight	Cashmere weight	Depth of cashmere	Length of wool	Length of cashmere
Body Weight	0.16~0.36	0.18					
Cashmere Weight	0.26~0.45	0.42	0.06~0.17				
Depth of cashmere	0.33~0.56	0.27	0.15~0.36	0.33~0.79			
Length of wool	0.23~0.32	0.59	-0.14~-0.28	0.11~0.38	0.51~0.69		
Length of cashmere	0.24	_	-0.18~-0.23	-0.09~-0.20	0.38~0.60	0.74~0.90	
Diameter of cashmere	0.14	_	0.13~0.32	0.24~0.35	0.02~0.11	-0.17~-0.28	-0.27~-0.31

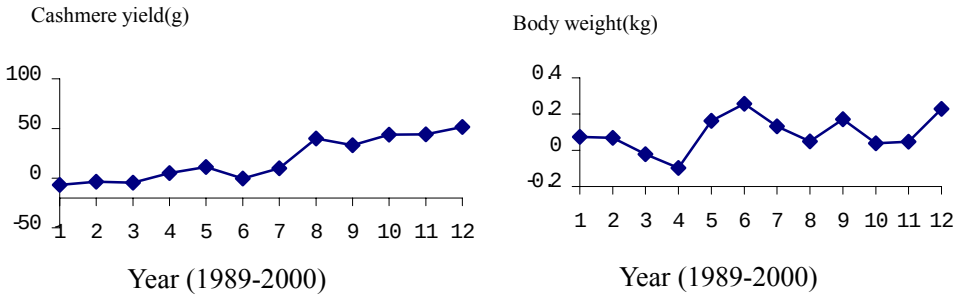

Figure 1. Estimated genetic trends of weighted average breeding values for cashmere yield and body weight each year (1989-2000)

Cashmere quality. Current selection objective traits are cashmere yield and body weight, and they may be favorable low quality cashmere goats. Phenotype trends for cashmere quality should be studied under this breeding method. The study concluded that selecting cashmere yield and body weight as objective traits in cashmere goat breeding may not reduce the cashmere quality based on Table 3 in comparison with Table 1.

General remarks. In the absence of detail recording on farms (common in many provinces in China), the data used to edit procedure for choosing the three traits are necessary. In this study, litter size was selected only if they had low reproduction ability. A complete survey for all

economically important traits was not possible in our case. Therefore, selection of cashmere yield, body weight and litter size from this study can be considered to be reliable breeding method for cashmere goat.

Table 3. Quality of cashmere (averages of length and diameter)

Year	Length of cashmere (cm)					Diameter of cashmere (um)				
	1 yr. dam	1 yr. sire	Sire	Dam	Mean	1 yr. dam	1 yr. sire	Sire	Dam	Mean
1998	9.3	9.6	9.9	9.3	9.4	13.2	12.9	13.2	13.8	13.7
1999	9.3	9.1	9.3	9.1	9.1	12.8	12.8	13.0	13.5	13.4
2000	9.0	9.4	9.8	9.2	9.2	12.9	12.5	12.7	13.7	13.5

This study provided survey of important economic traits, estimates of genetic parameters and genetic trends for both BLUP breeding method and common used breeding method for Albas Cashmere Goat Breeding Farm.Results showed that, as opposed to using common or traditional direct breeding value selection, BLUP of two traits and independent culling of one trait were used to get total breeding values of all goats was suitable to select NM cashmere goats. This study demonstrated that it is important to include quality traits for the genetic improvement of cashmere goat in the breeding goal and hence to address economical concern of cashmere quality in cashmere goat, but it is impossible in NM, China now and may come true in the near future.

IMPLICATIONS

Overall, our results demonstrate that breeding system for improved quality and quantity of cashmere in Nei Mongol Cashmere Goat is feasible. Some elements of the genetic evaluation design are proposed to breeders: importance of cashmere yield, body weight and litter size, easiness of handling for selection and mating and breeding benefis. At present, the cashmere goat breeding in different provinces in China is basically independent of each other and the population size at each farm in each province is generally small, for example, only about 8,200 cashmere goats in Albas.One way to increase population size is to join the neighbored provinces together, which can be realized greatly by selecting and utilizing common bucks across provinces. Moreover, in each provience, only about 25% of active breeding goats participate breeding testing programs and only 5-10 young bucks are actually used each year. This situation needs to be changed very urgently according to this study.

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