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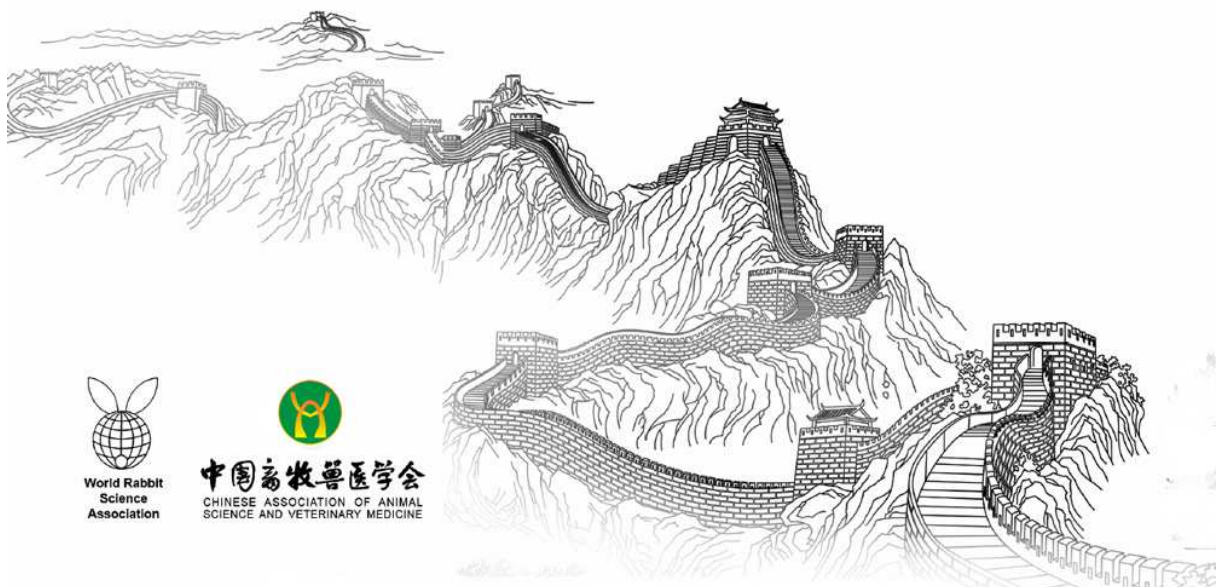
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OPTIMUM WOOL HARVEST INTERVAL OF ANGORA RABBITS

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ABSTRACT

It is important to evaluate the commercial lifetime and optimum wool harvest interval of Angora rabbits. In this study, 100 shorn Angora rabbits (2 months of age; 50% female) were housed in a farm in East of China. The commercial lifetime, optimum wool harvest interval, wool production rates, feed intake, and weight gain of Angora rabbits were evaluated. The optimum wool interval was 75 d, when the average fiber length reached 55.0mm. Wool production were lower during the 2nd and 3rd periods (youth stage) than during the 4th and 12th periods ($p < 0.05$). Thereafter, wool production rapidly decreased from the 13th period, reaching the lowest during the 14th period ($p < 0.05$). Therefore, the commercial lifespan of Angora rabbits was approximately 28 months. The ratio of feed intake to wool production during the 2nd and 4th was significantly higher compared to that in adult animal stage ($p < 0.05$). On the other hand, the ratio increased during the 14th periods ($p < 0.05$). Daily weight gain was significantly higher during the 2nd period than during any other period of the adult stage ($p < 0.05$). Body weight changed gradually during the adult stage. From 11th through the 14th periods, daily weight gain was negative ($p < 0.05$). Therefore, animal age had significant effects on wool production, ratio of feed intake to wool production and daily weight gain. Wool production was significantly higher during the spring and winter than during the summer and autumn ($p < 0.05$). Concomitantly, the ratio of feed intake to wool production was lower in the spring and winter than in the summer ($p < 0.05$). Daily weight gain was the highest in the autumn, followed by the spring ($p < 0.05$). Therefore, wool production, ratio of feed intake to wool production and daily weight gain were dependent on the season. Wool production decreased significantly during the summer. The spring provides the best environment for Angora rabbits.

Keywords: harvest interval, Angora rabbits, wool production, daily weight gain

INTRODUCTION

Angora rabbits represent valuable resources for the wool industry. China, which exports 92% of the global rabbit wool, is the largest exporter of Angora wool. However, climatic changes are a major threat to the viability and sustainability of Angora wool production systems in several regions of the world including China (Gaughan et al., 2009). Feed intake, body growth, fiber follicle activity and wool growth vary with season in fat-tailed Sanjabi sheep (Salehian et al., 2015), similarly, wool production in Angora rabbits also changes with season (Rochambeau et al., 1991).

Based on Chinese standards (GB/T13832-2009), high quality Angora fiber is > 45 mm in length (in vivo length > 55 mm). Suitable wool harvest intervals and reasonable farm management practices may improve the quality and yield of Angora wool. The objective of this study was to evaluate the commercial lifetime, optimum wool harvest interval, wool production rates, feed intake, and weight gain of Angora rabbits during different seasons in East China.

1-MATERIALS AND METHODS

Animals, feeding, and sampling

At the beginning of the study, 100 shorn Angora rabbits (2 months of age, 50% female) were housed in well-ventilated sheds at the breeding rabbit farm in Shandong Academy of Agricultural Sciences. The animals were fed a pelletized diet consisting of 14.8% crude fiber, 16.8% crude protein, 0.8% lysine, 0.6% sulfur amino acid, 2.4% crude fat, and 1.7% minerals (1.1% calcium and 0.6% calcium), with a total digestible energy of 9.7 MJ/kg. The rabbits had ad libitum access to feed and water.

Feed consumption was recorded daily, and rabbits were weighed weekly. Shed temperature and relative humidity were recorded twice daily at 8:00 h and 14:00 h. Fiber length at different body points (back, buttocks, neck, and two sides of the body) were measured with a steel ruler. When Angora fiber was \geq 55.0 mm in length, the wool was removed with clippers and stored in plastic bags for analyzes. This study was performed for approximately 3 y, which represents the lifetime of Angora rabbits. Wool harvest time was recorded.

All animals were handled according to the animal processing protocols established by national and local animal welfare agencies. The study was approved by the Shandong Province Biological Studies Animal Care and Use Committee.

Parameters studied

Each wool harvest interval was calculated. Wool production rates, feed intake, weight gain, temperature and relative humidity of each wool harvest period were determined on day 0 and on the day prior to harvest.

Statistical analysis

Data were analyzed by one-way ANOVA and Duncan's test using SPSS17.0 (SPSS, Chicago, IL, USA). Data are presented as mean \pm SEM. Statistical significance was set at $p < 0.05$.

2-RESULTS AND DISCUSSION

2.1 Optimum wool harvest interval

At 2 months of age, rabbits were shorn with clippers (1st period). During a 3-y lifespan, Angora rabbits had 14 wool harvest periods. The wool harvest intervals are presented in Table 1. The wool harvest interval was approximately 65 d between the 2nd and 3rd periods and 75 d between the 4th and 11th periods. However, between the 12th and 13th, when the rabbits were 26 months of age, the interval increased to 80 d. Therefore, animal age had an effect on fiber growth: fiber grew slower with increasing animal age.

Table 1: Optimum wool harvest interval of Angora rabbits during different seasons

Wool harvest period	Wool harvest time (yy.mm.dd)	Age (months)	Average temperature (°C)	Average relative humidity	Wool harvest intervals (d)
2	12.4.6–12.6.11	3–4	23.3	53%	66
3	12.6.11–12.8.12	5–6	28.9	76%	62
4	12.8.12–12.10.25	7–9	22.4	74%	74
5	12.10.25–13.1.9	9–12	5.8	73%	76
6	13.1.9–13.3.25	12–14	5.3	80%	75
7	13.3.25–13.6.8	14–17	21.4	58%	75
8	13.6.8–13.8.28	17–19	29.7	75%	74
9	13.8.28–13.11.8	19–21	21.3	62%	72
10	13.11.8–14.1.23	21–23	7.2	76%	77
11	14.1.23–14.4.8	23–26	7.0	70%	76
12	14.4.8–14.6.26	26–28	25.4	54%	80
13	14.6.26–14.9.13	28–31	29.7	65%	79
14	14.9.13–14.12.1	31–33	18.9	68%	80

2.2 Wool production

Wool production rates are presented in Figure 1. Wool production was significantly lower during the 2nd and 3rd periods compared to that during the 4th and 12th periods ($p < 0.05$). Thereafter wool production rapidly decreased from the 13th period, reaching the lowest rates during the 14th period ($p < 0.05$). Therefore, wool production efficiency decreased after 28 months of age, the useful commercial life of Angora rabbits was approximately 28 months.

During the peak stage of wool production, there were significant differences amongst the seasons. Wool production was significantly higher during the spring (7th and 12th periods) and winter (5th, 6th, 10th and 11th periods) than during the summer (8th and 13th periods) and autumn (9th period, $p < 0.05$). The summer had the lowest wool production rates ($p < 0.05$).

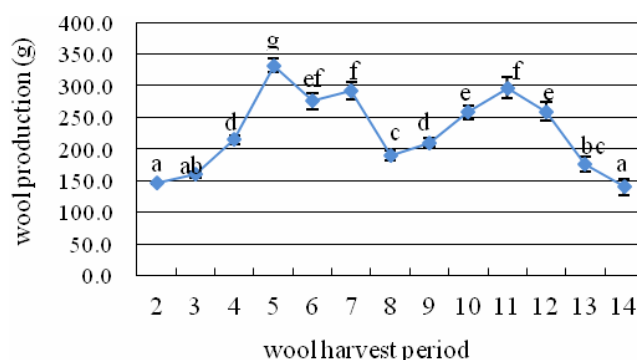


Figure 1: Wool production during different wool harvest periods. Changes in wool production (g) during 14 wool harvest periods were recorded. Different letters represent significant differences ($p < 0.05$).

Feed intake to wool production ratios are shown in Figure 2. The feed intake to wool production ratio was significantly higher during the 2nd and 4th periods (youth stage) compared to that in adult animal stage ($p < 0.05$). Additionally, ratio reached the highest during the 14th period ($p < 0.05$). Similar results were obtained with wool production. The ratio of feed intake to wool production was lower during the spring (7th and 12th periods) and winter (5th, 6th, 10th and 11th periods) than during the summer (8th and 13th periods, $p < 0.05$).

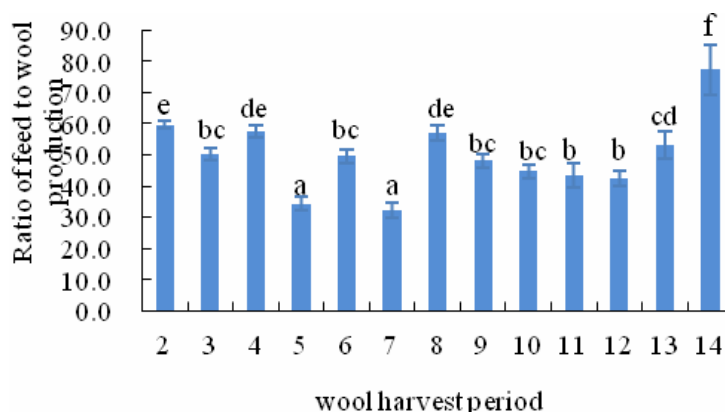


Figure 2: Ratio of feed to wool production during different wool harvest periods. Changes in feed intake to wool production ratio during 14 wool harvest periods were recorded.

Figure 3 shows the daily weight gain during each period. Daily weight gain was significantly higher during the 2nd, 3rd and 4th periods (youth stage, $p < 0.05$), because of rabbits were in growth phase. Thereafter, body weight changed gradually during the adult animal stage. However, from the 11th and 14th period, daily weight gain was negative ($p < 0.05$). Therefore, animal age had a significant effect on daily weight gain. Finally, daily weight gain significantly increased during the spring and autumn (7th and 9th periods) compared to values during the winter (6th, 10th, and 11th periods) and summer (8th and

13th periods, $p < 0.05$). This result suggested that seasons affected body weight in the adult rabbit. Angora wool production varies during the lifespan of the animal. Our study findings revealed that the commercial lifetime Angora rabbits under farm management systems practiced in Shandong province was approximately 28 months. The optimal wool harvest interval was approximately 75 d, similar to the traditional harvest interval followed in China (73 d). It is important to evaluate the effects of different factors on hair follicle activity and wool growth, because this information assists in the design of breeding strategies and shearing practices.

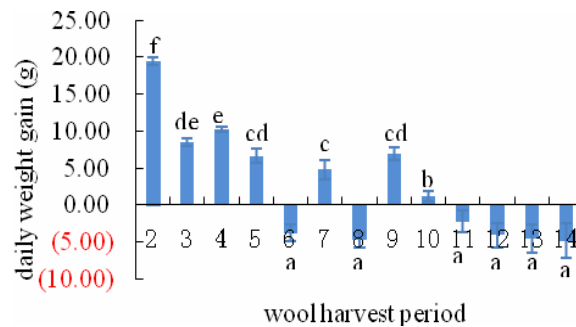


Figure 3: Daily weight gain during different wool harvest periods. Changes in daily weight gain during 14 wool harvest periods were recorded.

In sheep, wool production is affected by genetic and environmental factors (Mirmahmoudi et al., 2011; Winder et al., 1995). The increased Angora wool production observed during the spring and winter was concurrent with decreased feed intake to wool production ratios. Similar seasonal variations were observed for daily weight gain, with maximum values obtained in the autumn, and minimum values observed in the summer and winter. Therefore, season is important in wool production, feed intake to wool production ratio, and daily weight gain of Angora rabbits. Wool production performance was the lowest in the summer. It has been reported that high temperature and humidity conditions affect wool production performance of Malpura ewes (Sejian et al., 2013). Spring, which has an average temperature and relative humidity of 21.4°C and 58%, respectively, provides the best conditions for Angora wool production.

3 - CONCLUSIONS

The results of this study revealed that 1) the optimal wool harvest interval was 75 d; 2) the commercial lifetime of Angora rabbits was 28 months; 3) wool production, feed intake to wool production ratio, and daily weight gain were age dependent and 4) associated with seasonal fluctuations.

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