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Studies on the Eeffect of Ambient Temperature and Relative Humidity on Feed Intake and Wool Output of Angora Rabbits

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Abstract

This study was carried out in Guangdong Province of China(subtropical zone). Thirty adult Angora rabbits were used in the eighty-eight-day experiment.The results showed that the effect of ambient temperature on the feed intake of Angora rabbits was very significant ($P<0.01$), whereas relative humidity had little effect in this aspect ($P>0.05$). The feed intake of Angora rabbits decreased or increased 0.168 gram with every degree of increased or reduced of ambient temperature. When the ambient temperature was around 20 °C or the relative humidity around 52% , the feed intake of Angora rabbits was the highest. The annual wool output of 122 adult Angora rabbits indicated that the effect of ambient temperature on the wool output was very significant ($P<0.01$). The relative humidity had little effect on the wool output ($P>0.05$). When the ambient temperature increased or reduced 1°C, the wool output of Angora rabbits reduced or increased 4.244 gram. When ambient temperature ranged from 12 °C to 23 °C or relative humidity ranged from 60% to 75%, the total wool output and the high quality wool output of Angora rabbits were higher. The wool output of Angora rabbits in winter, spring and autumn was higher than that in summer ($P<0.01$), with the increcements of 49.1%, 48.6% and 28.6% respectively. The wool output of Angora rabbits in winter and spring were higher than that in autumn ($P<0.01$), with the incresements of 16.0% and 15.6% respectively. The difference of the wool output of Angora rabbits between winter and spring was not significant ($P>0.05$).

Key words: Ambient temperature ; Relative humidity ; Angora rabbit ; Feed intake ; Wool output

INTRODUCTION

It's well known that the feed intake and the wool output of Angora rabbits are affected both by ambient temperature and by relative humidity, but there is no sufficient study results revealling the extents of these temperature and humidity influences. This study was aimed to further investigation on the extents of the inflences of ambient temperature and relative humidity on the feed intake and the wool output of Angora rabbits.

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MATERIAL and METHODS

1. data from our experiment: The experiment was carried out in the intensive breeding rabbit farm in Fugang county of Guangdong Province, which is located in a subtropical zone. These data were used to analyse the interrelationship of feed intake with ambient temperature and relative humidity. The annual average ambient temperature of the area is 20.8 °C, with the highest being 38.5 °C and the lowest , -4.2 °C . The annual average relative humidity and the annual precipitation are 78% and 2001.3 mm respectively. The experimented rabbits were the homebred offsprings of Angora rabbits which originated from West German. Thirty audult healthy Angora rabbits which close in age and body size were raised in the samiliar feeding conditions. The actual feed intake of the experimented rabbits and the ambient temperature and the relativ humidity of the rabbit house were recorded every day. The experimental period was 88 days (from January 1, 1988 to March 28,1988). All experimented rabbits were not bred during the experimental period.

2. data from practical production: These data were used to analyse the interrelationship of the wool output of Angora rabbits with ambient temperature and relative humidity. The actual data of wool output were collected from breeding herd (age: approximately 5 months; weight: approximately 5 kg; shearing period: 90 days) of the intensive breeding rabbit farm in Huai- yuan of Guangdong Province which is also located in the subtropical zone.The annuual average ambient temperature is 21.6 °C, with the highest being 39.1 °C and the lowest, -5 °C. The annual average relative humidity is 79%, and the annual precipitation is 2347.2 mm.

RESULTES

1. Rresults showing the effect of ambient temperature and relative humidity on the feed intake of Angora rabbits

1.1 Analysis Results

Table 1 Stastistic table of ambient temperature, relative humidity and feed intake

Items	n	ambient temperature	relative humidity	feed intake
X+-S	88	13.50 +- 4.13	79.89 +- 9.86	148.48+-9.39

Table 2 Regression equations for ambient temperature, relative humidity and feed intake

Items	Regression Equation	n	F	
temperature, humidity and feed intake	Y=177.01-1.1555X1-0.1618X2	88	15.4040	t1=4.04 t2=1.25
temperature and feed intake	Y=86.424+23.527X1-2.959X1^2 +0.153X1^3-0.00277X1^4	83	20.0867	R^2=0.491
humidity and feed intake	Y=-3209.5+205.8X2-4.6X2^2 +0.045X2^3-0.0000158X2^4	88	1.5770	R^2=0.070

Note: X1 denotes ambient temperature;
X2 denotes relative humidity ;
Y denotes feed intake

1.2 Discussion

1.2.1 The linear regression relationship of the ambient temperature and the relative humidity to the feed intake of Angora rabbits is very significant(P<0.01). When the ambient temperature increased or decreased 1 °C (relative humidity unchanged) , the feed intake of Angora rabbits decreased or increased 1.1555 gram respectively. And when rellative humidity increased or decreased 1% (ambient temperature unchang) , the feed intake of Aangora rabbits decreased or increased 0.1618 gram respectively (table 2).

1.2.2 The effect of ambient temperature and relative humidity on the wool output of Angora rabbits were very significant (P<0.01). It showed regular curvilineal changes according to the curvilinear regression equation: Y = 86.242+23.527 X1-2.959 X1^2+0.1527 X1^3-0.00277 X1^4 . When the ambient temperature reached 20°C , the feed intake of Angora rabbits was the highest. The feed intake of Angora rabbits increased gradually corresponding to the rising of ambient temperature in the range from 14 °C to 20 °C , and decreased gradually along with the increase of ambient temperature when the latter exceeded 20 °C (Table 2 , Figure 1).

1.2.3 Relative humidity had little effect on the intake of Angora rabbits (P>0.05). The feed intake of Angora rabbits changed according to the curvilinear regression equation: Y = -3209.5 + 205.8 X2 - 4.6 X2 ^2 + 4.6 X2^2 + 0.045 X2^3 - 0.00158 X2^4 . When the relative humidity was 52% (44-93%), the feed intake of Angora rabbits were the highest (Table 2 , Figure 2).

2. Results showing the effect of ambint temperature and relative humidity on the Wool Output of Angora Rabbits

2.1 Statistical Result (table 3)

Table 3 actual average temperature , humidity and wool output each month

Items\Month		3	4	5	6	7	8	9	10	11	12	1	2	year
average temperature (°C)		16.1	22.5	25.5	28.1	29.1	28.3	27.3	24.8	18.7	13.6	12.2	13.1	21.6
aeverage relative humidity (%)		83	86	86	82	80	82	83	80	62	64	77	86	79
shearing output (gram)	n	12	15	6	13	19	9	4	27	4		13		122
	$\bar{X}$ ± S	196.2 ± 18.8	186.7 ± 21.6	174 ± 17.8	136.8 ± 21.7	112.3 ± 19	141 ± 24.3	158.5 ± 19,9	161.6 ± 32.2	170.3 ± 23.6		138.5 ± 21.2		
shearing output each season (gram)	n	33			41			35				13		
	$\bar{X}$ ± S	556.9±11.14			390.1±15.50			490.4±6.12				188.5±21.2		

Table 4 The correlation of ambient temperature and relative humidity with the wool output of angora rabbits

Items	n	γ	Remarks
temperature and wool output	10	- 0.805 **	strong negative linear correlation
relative humidity and wool output	10	- 0.0058	weak negative linear correlation

Table 5 The regression coefficiency of ambient temperature and relative humidity with the wool output of Angora rabbits

Items	Regression Equation	n	F
temperature , humidity with wool output	Y = 158.216 - 4.244 X1 + 1.288 X2	10	10.368 *
temperature with wool output	Y = SQR(4326.49+3968.14X1-121.91X2^2)	10	2.15 E6 **
relative humidity with wool output	Y = 188.07 - 13.40 log X2	10	3.5 E-3

Note: X1 denotes ambient temperature;
X2 denotes relative humidity ;
Y denotes wool output

2.2 Discussion

2.2.1 The effect of ambient temperature on the wool output of angora rabbits were very significant($P<0.01$). The regularity of the eeffect was that the wool output of Angora rabbits approached the peak within the range from 12 °C to 23 °C, and decreased when the ambient temperature rose up to 25 °C to 27 °C , and dropped more evidently when the temperature was over 28 °C.

The relative humidity had little effect on the wool output of Angora rabbits statistically ($P>0.05$), ever it could be figured out that the wool output was the highest when the relative humidity ranged from 60% to 75% by the regression equation in Table 5. The effect of relative humidity on the wool output had no regularity (Table 4 , Figure 3 & 5) .

2.2.2 Within the ranges of ambient temperature from 12 to 30 °C and of relative humidity from 62% to 86%, the wool output of Angora rabbits increased or decreased 4.244 gram along with every degree reduction or increse of the ambient temperature respectively (relative humidity unchanged); or increased or decreased 1.288 gram in pace with every percent increase or reduction of relative humidity (ambient temperature unchanged). (Table 5)

2.2.3 The highest monthly wool output of Angora rabbits appeared in March (196.2 +– 18.6 gram), whereas the lowest appeared in July (112.3 +–19.0 gram). The wool output decreased along with the increment of ambient temperature from Apirl to June, and then increased as the ambient temperature descended from August to December and from January to February (Table 3).

2.2.4 The wool output of Angora rabbits varied greatly in different seasons. The seasonal wool productions of Angora rabbits in winter, spring and autumn was higher than that in summer ($P<0.01$) with the increments of 49.1% , 48.6% and 28.6% respectively. Although the seasonal wool productions both winter and spring were 1.16 times and 1.156 times respectively as high as that in autumn ($P<0.01$), there was no significant difference in those two seasons ($P>0.05$).

2.2.5 The percentage of high quality wool was not affected significantly by ambient temperature ($P>0.05$), but was obviously affected by relative humidity($P<0.01$). The optimum temperature for wool priduction existed around March and May (16 - 25 °C), but the relative humidity reached the highest point of the year(83% to 86%). Therefore the percentage of the first class wool was the lowest (51.6%) and that of the third class wool was the highest (31.0%), when comparing to the wool quality in the other months of the year (Table 6).

Table 6 ambient temperature , relative humidity and the percentage of the high quality wool output

months	ambient temperature (°C)	relative humidity (%)	n	total wool wool output (gram)	percentage of first class wool	second class wool	third class wool
Dec.,Jan., Feb.	12 - 14	64 - 86	83	12790	56.1	21.5	22.4
march, Apr.,May	16 - 25	83 - 86	119	19305	51.6	17.4	31.0
June,July, Aug.,Sep.	27 - 30	80 - 83	186	24090	58.9	12.6	28.5

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CONCLUSION

The results from this study demonstrated that the ambient temperature and relative humidity are the climatic factors affecting the maintenance of good physiological conditions and the full- play of the productive potentiality of domestic rabbits. Between these two factors, the ambient temperature was far more important. This study revealed that ambient temperature had a significant effect on both feed intake and wool output of angora rabbits ($F<0.01$). Under the same feeding and management conditions and keeping the relative humidity unchanged, when the ambient temperature increased 1 °C, the feed intake and the wool output of Angora rabbits would decreased 1.1555 gram and 4.244 gram respectively, and vice versa. In a certain range of relative humidity , the feed intake and the wool output of Angora rabbits would decreased 0.1618 gram and 1.288 gram respectively when the relative humidity decreased, provided that the ambient temperature be fixed. For the highest feed intake, the optimum ambient temperature and the relative humidity were 20 °C and 52 % respectively; And for the highest wool output and high quality wool production, the optimum ambient temperature and relative humidity lay around 12 - 23 °C and 60 - 75 % respectively. Regarding to the seasonal influence, the lowest wool output of Angora rabbits existed in summer when the ambient temperature was the highest in subtropical zone. Higher wool production could be obtained during winter and spring, due to the moderate temperature in these two seasons. The wool output in winter was 49.1% higher than that in summer according to the results of this study.

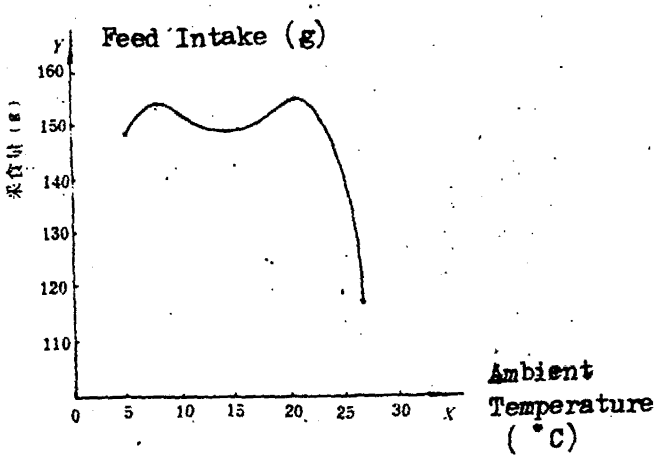

Figure 1 The relation between ambient temperature and feed intake

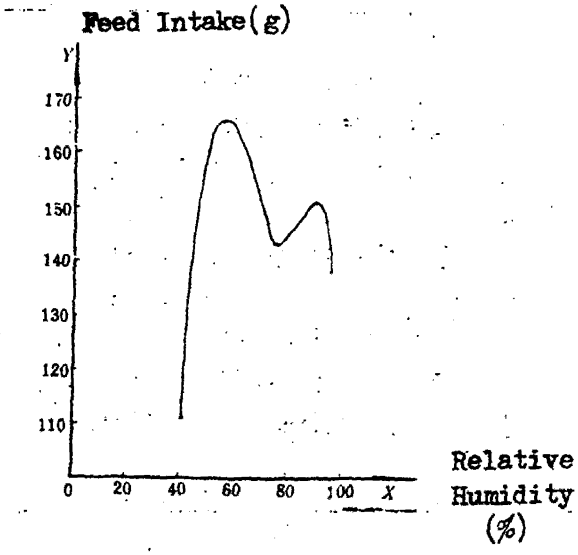

Figure 2 The relation between relative humidity and feed intake

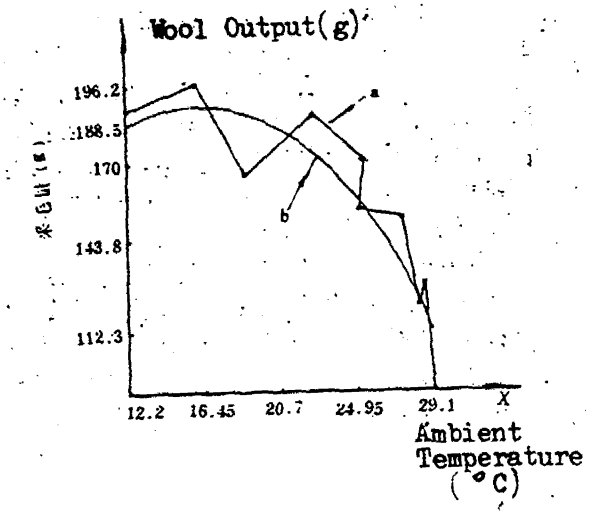

Figure 3 The relation between ambient temperature and wool output

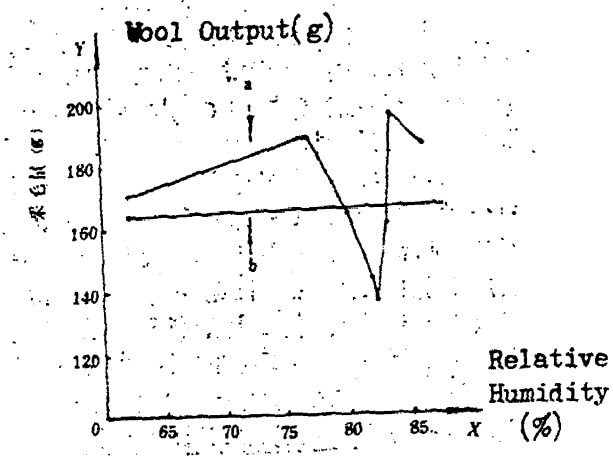

Figure 4 The relation between relative humidity and wool output

a. The broken line of original figures

b. $y = SQR(4326.49 + 3968.14X_i - 121.91X_i^2)$