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Investigations on adaption to high temperatures
by Angora rabbits.

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Introduction:

High environmental temperatures reduce performance in rabbits with normal hair. This effect is increased by the stronger insulation of Angora rabbits' wool-fleece. Main cause of reduced performance found in animals with longer hair is the increasing difficulty in regulating body-temperature. Angora rabbits try to solve this problem by reducing their feed-intake.(Figure). This lowers weight-gain and wool-yield which both depend upon supply of nutrients (Table 1). However performance and health otherwise is reduced as well by physiological stress caused by regulation of body-temperature before and after shearing. Semen-quality declines and embryonic mortality rises with increasing length of the wool-fleece (Brockhausen et al., 1979).

But this stress caused by shearing or epilation can be reduced by higher environmental temperatures. Hereby optimal temperature varies between 26 and 28 centigrades (Vermorel et al., 1988). If temperatures are lower within the first few days after wool-harvest, feed-intake will increase and furthermore fat-reserves have to be mobilized in order to provide the necessary energy for keeping up body-temperature. This results in changes of metabolism and lowering of body-temperature within this period which can lead to further complications.

Insulation-capacity of the wool-fleece depends on length and thickness of hair and, above all, on the length of shearing-intervals. Therefore we investigated to what extend several parameters of performance can be influenced by shortening of the shearing-interval.

1. Wool-yield (Table 2)

In two experiments we compared intervals of 91 days with those of 70 and 61 days respectively. Environment-temperature varied between 18 and 23 °C.

In each experiment 15 male angora rabbits received pelleted allmash feed containing 10,5 MJ digestible energy and 16% raw protein (with 0,85% methionin and cystin) ad libitum.

In comparison to a shearing-interval of 91 days the shorter period of 70 or 61 days resp. raised the yearly wool-yield by 13% and 23% and lowered feed-intake per kg of wool by 6,9% and 9%. Higher intake of feed raised the animals' weight as well. Shortening of the shearing-interval decreased the length of wool. There was no wool longer than 6 cm any more. At the same time the proportion of felt declined.

2. Growth-development of young animals (Table 3)

Optimal growth-development of young animals gives a prerequisite for good performance of the adults. We investigated how far the reduction of feed-intake was followed by a decrease of growth. In these experiments 79 angora rabbits aged between 8 and 10 weeks were sheared either

- (1) after 9 weeks, or
- (2) three times with intervals of 3 weeks.

The animals were fed pelleted allmash feed ad libitum. Ambient temperature varied between 20 and 23 centigrades.

The shortened interval between shearings resulted in increase of weight-gain during the nine weeks' trial-time by 16% and of feed-intake by 13%. Thus the amount of feed per kg weight-gain decrescent by 3%.

3. Reproduction

Parameters of reproduction in male and female angora rabbits apparently are influenced not only by their feed-intake, which in itself depends on the length of the wool-fleece. Stress resulting from impeded regulation of body-temperature after wool-harvest has its effect, too. Investigations carried out in order to clarify this phenomenon had the following results:

At a shearing-interval of 12 weeks, semen-quality in males deteriorated after the 9. week. The negative effects (abnormalities in sperm-heads) could be found as long as 3 weeks after shearing. A shearing-interval of no more than 8 weeks is suggested.

In females the highest conception-rate (70,4%) and lowest rate of embryonic mortality were found, if the does were shorn at the day of insemination. Shearing a few days prior to insemination lessened conception-rates. Apparently in some of the animals ovulation was triggered by tactile stimuli caused by the shearing-procedure.

Discussion:

Shortening of the shearing-interval reduce negative consequences of the complicated regulation of body-temperature caused by the wool-fleece even at relatively low ambient temperatures. This concerns growth itself, feed per kg weight-gain and wool and parameters of reproduction as well. Influence over wool-yield and feed per kg wool increased with ever shorter shearing-intervals. Thus one should assume that this effect rises with higher ambient temperatures. This seems to apply to the amount of feed in particular, as the rise of feed-intake after shearing is smaller at higher temperatures (first illustration). If temperatures are higher than those in the experiments described, further shortening of shearing-intervals might possibly be beneficial. It remains to be tried out, to what extent higher contents of proteins and essential amino-acids in the feed could compensate

the still persisting reduced feed-intake within the second half of the shearing-interval. This could enhance production of angora-wool under subtropical conditions concerning economy of feeding.

The present results point too the possibility of reducing the negative influence of high temperatures on reproduction in normal-haired rabbits by shearing the breeding-animals before summer. Their hair does not grow again up to the next moulting in fall. A trial might show whether short-haired rabbits (Rex) have a higher heat-tolerance than normal-haired rabbits.

The influence of this is depending from the highness of temperature and its daily changes. Therefore this assumption is not contrary to the findings of Finzi et al.(1992). Who doesn't found an influence of shearing on sperm volume and quality at normal haired males. But the environment temperatures in this experiment changed only from 19 hours with 22 °C to 5 hours eit 30 °C. It seems to be the phase with the higher temperature was to short, to have any influence on this parameters.

In Angora rabbits there exists a negative effect due to shortening of shearing-intervals, namely shorter wool and more labour. Still one should take into consideration that price-differences between grades have declined.

Summary:

Higher ambient temperatures complicate regulation of body -temperature in Angora rabbits more than of normal-haired rabbits. The resulting lower feed-intake is followed by slower weight-gain of growing animals and reduction of wool-yield. Furthermore the heat-stress will impair semen-quality and the embryos' surviving chances .

The experiments reported showed that shortening of shearing-intervals resulted in increased wool-yield and gain of weight, in improved feed conversion-rate and parameters of reproduction. The results are discussed. Investigations of the influence of shearing of normal- haired rabbits in summertime with regard to improve the parameters of reproduction are suggested .

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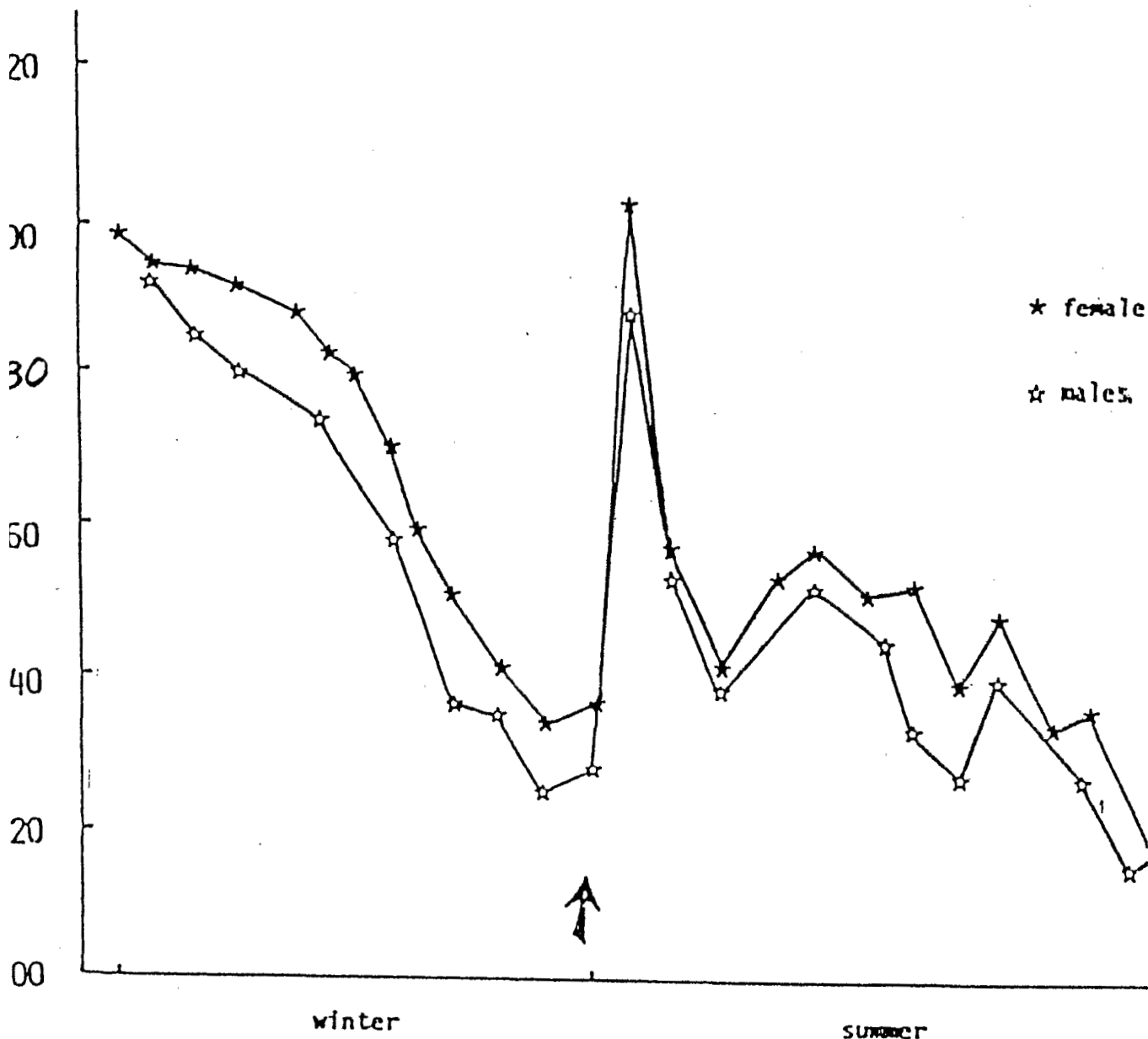
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FEED-INTAKE PATTERN OF ANGORA RABBITS AS INFLUENCED BY SEASON

(Arrow indicates shearing).



As wool growth in length, the increased insulating property of the fleece makes it increasingly difficult to regulate body temperature. As a result, feed intake declines during the course of the shearing interval. This tendency is aggravated by higher hutch temperatures. To assure a more even nutritional intake, the protein content - and especially the proportion of amino acids containing sulfur - can be increased in the second half of the shearing interval.

Table 1

RELATIVE EFFECTS OF TEMPERATURE ON FEED AND WATER INTAKE AND ON THE PERFORMANCE
OF ANGORA RABBITS

	5°C / 80 %	18°C / 70 %	30°C / 60 %
Wool	106	100	86
Top ₁ Grade Wool (> 6 cm long)	78	80	75
Feed intake	116	100	68
Water intake	92	100	105
Feed per kg wool	109	100	79

Stephan, Schlotaut, Lange (1979).

With rising temperatures, there is a corresponding drop in wool yield and feed intake. Since the reduction in feed intake exceeds that of the wool yield, feed conversion improves at higher temperatures.

Table 2

INFLUENCE OF SHORTENED SHEARING INTERVALS ON WOOL YIELD AND FEED
CONVERSION OF ANGORA RABBITS

Shearing interval	days	91	70	61
Wool yield / year	g	902	1027	1101
" " " relative	%	100	113	123
1 st grade	%	75	2	-
Felt	%	1,3	0,5	-
Feed intake / day	g	170	179	188
Kg Feed / kg wool	kg	69,15	64,41	62,86
" " " relative	%	100	93	91

Shortening of shearing interval increase the wool yield more than feed intake. Therefore feed conversion is improved.

Table 3

EFFECT OF SHEARING INTERVALS ON FEED INTAKE AND GROWTH PATTERNS
IN GROWING ANGORA RABBITS

(9. to 18. week of age = 9 weeks)

	9 weeks shearing interval	3 weeks shearing interval	Advantages (+) or Disadvantages (-) from 3-week shearing interval
Liveweight gain kg.	1,45	1,68	+ 11,6 %
Feed intake kg	8,72	9,85	- 12,9 %
Kg Feed per kg gain	6,01	5,86	+ 2,5 %

The fleece also makes it more difficult for growing Angora rabbits to regulate their body temperatures. A long shearing interval thus retards body growth, due to the reduced feed intake. For the same reason, live weights of adult animals are lower at high temperatures, especially in subtropic and tropic regions.