EFFECT OF 10-, 12- AND 14-HOUR CONTINUOUS AND INTERMITTENT PHOTOPERIODS ON THE DEVELOPMENT OF FUR PRIME OF REX RABBITS

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Abstract - Experimental trials were conducted to evaluate the effect of 10-, 12-, and 14-h continuous and intermittent photoperiods on the priming of Rex rabbit fur. Sixty dark-colored Rex rabbit kits were equally divided into six identical, environmentally controlled rooms under the following photoperiods: (1) 14L:10D; (2) 12L:12D; (3) 10L:14D; (4) 1L5.5D:1L:5.5D:1L:10D; (5) 1L:4.5D:1L:4.5D:1L:12D and (6) 1L:3.5D:1L:3.5D:1L:14D. These schedules simulated 10-, 12-, and 14-h continuous and intermittent subjective days. Rabbits were sacrificed at both three and five months of age to evaluate prime. There were no statistical differences between treatments or lighting methods for rabbits sacrificed at three months. However, there was a tendency toward more surface area in prime from intermittent lighting. Prime was consistently more extensive from intermittent lighting for pelt backs (63.3 vs. 51.5%) and front (58.6 vs. 54.6%) as well as the entire pelt (61.5 vs. 52.6%). Priming was quite similar from both rabbit fronts and backs as a percentage of available area. However, since backs represent about 60% of the pelt surface area, they yielded significantly ($P<.05$) more prime than fronts for rabbits under both continuous (58.6 vs. 41.4%) and intermittent (61.8 vs. 38.2%) lighting. Pelts from the five-month trial were similar in state of prime for continuous versus intermittent lighting (80.6 vs. 82.8%). The percentage of pelt in prime was significantly ($P<.05$) greater (81.7 vs. 57%) at five than at three months. Prime appeared to initiate in the middle of the back and front of the pelt and progress outward to the sides. It was concluded that the duration of the light-day (10, 12, or 14 h) did not have an appreciable effect on promoting prime at either three or five months of age. Intermittent lighting may stimulate, to a limited extent, the early incidence of fur prime.

INTRODUCTION

The Rex rabbit is raised primarily for its fur. It is distinguished from other rabbit breeds by the fact that both its guard hair and underfur are of the same length. In other breeds the guard hair is considerably longer. It is most desirable to harvest the rabbit's pelt when the fur is in prime. Hair is said to be in prime during the telegenic or resting phase which is the last phase of the three stages of growth (anagen, catagen and telogen). When the hair reaches the resting phase, its growth has ceased. Also at this juncture the hair pigment has been withdrawn from the skin. Hence, when an animal is in prime, pigment cannot be seen on the leather side of the pelt which will have a creamy white color.

It has been observed that the stress condition of limited feed intake (50 or 75% of normal) has a stimulatory effect on inducing prime (TAYLOR and JOHNSTON, 1984). In nature, animals in the wild reach prime during periods of sparse feed intake and diminishing daylight. The objective of this research was to observe if reduced day length and/or light quantity stimulate the onset of prime in Rex rabbits.

The inducement of prime has also been associated with time of the year (PETERSEN, 1992), age (PETERSEN, 1992) and length of the photoperiod (VRILLON et al., 1988). Under natural conditions superior pelts are harvested in the months of November, December and January at time when fur growth is stable. Molting is common during the months before or after. PETERSEN (1992) harvested Castor Rex pelts at 6, 7 and 8 months of age and noted that the priming of the back and hip was significantly greater in the 7- and 8-month groups while priming on the underside was better for the 6 and 8-month groups. He further observed that pelt quality regarding hair length and quality of guard hairs significantly better in the 8-month group and darkest pelts in the 7-month group. He concluded that Castor Rex likely should be pelted after reaching 8 months of age.

VRILLON et al. (1988) observed the effect of photoperiods of 16L:8D and 8L:16D on the fur quality of common and Rex rabbits. The second group was under 16 hours of light daily until nine weeks of age. They observed that the shorter photoperiod accelated the molt which induced the 3rd coat by one week., sped the growing gradient and gave a compact winter pelt at 23 weeks.

Experimental procedure

Sixty, 30-day-old, dark-colored Rex kits were divided into six identical, environmentally controlled rooms. The kits were individually confined in cages measuring 76 cm x 46 cm x 46 cm. Each room was placed under a different photoperiod, and they were as follows: (1) 10L:14D ; (2) 12L:12D ; (3) 14L:10D ; (4) 1L:3.5D:1L:3.5D:1L:14D ; (5) 1L:4.5D:1L:4.5D:1L:12D and (6) 1L:5.5D:1L:5.5D:1L:10D (Figure 1). These schedules simulated 10-h, 12-h, and 14-h continuous and intermittent light-days. The lighting was incandescent and with an intensity of 100 lux at the level of the animals. Feed (Table 1) and water were offered free choice.

Figure 1. Experimental photoperiods

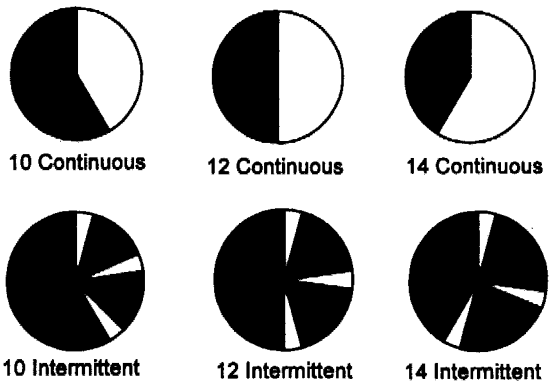

Table 1 : Experimental ration

Ingredients	Amount (%)
Wheat, ground	26.3
Soybean meal	16.2
Suncured alfalfa	50
Molasses	3
Bentonite	2
Dicalcium phosphate	1.1
Vitamin-mineral premix	1
Salt	0.4
Total	100
Calculated Analysis	
Crude protein (%)	18
Metabolizable energy (kcal/kg)	2,355
Crude fiber (%)	14
Fat (%)	2
Calcium (%)	1.1
Phosphorus (%)	0.5
Methionine-cystine (%)	0.8

Dark-haired kits were used to enable quantifying the portion of the pelt in prime. The parts of the pelt not in prime were easily identifiable by the presence of pigment (melanin and pheomelanin) on the leather side of the pelt as contrasted to the portions in prime that were creamy white. Half of the rabbits were sacrificed at three months and the remainder at five. After skinning the rabbits, the pelts were dried on wire tensors. From photocopies of the pelts a planimeter was used for measuring the total area of the skin and the portion in prime.

Data were analyzed using analysis of variance, and means were compared using Duncans New Multiple Range Test (OTT, 1988).

RESULTS AND DISCUSSION

Table 2 illustrates the effect of photoperiod length and type on fur priming of three-month-old Rex rabbits. There was no significant ($P<.05$) differences among or between the continuous and intermittent photoperiods. There was, however, a tendency for intermittent lighting to be more stimulatory than continuous lighting. Rabbits exposed to each intermittent photoperiod primed at a numerically higher rate than did rabbits under continuous light of a corresponding length.

The pattern for fur priming appears to initiate in the middle of either the back or the front of the pelt and then move to the sides as illustrated in the pelt simulation in Figure 2.

Figure 2 : Rate and areas of prime of light method

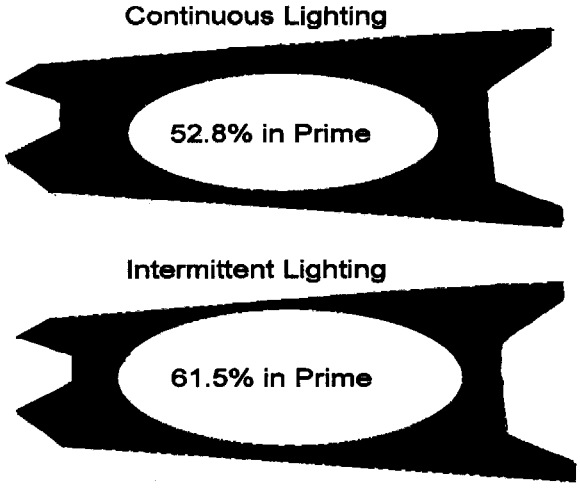

Table 2 : Effect of intermittent and continuous photoperiods on the development of prime in three-month-old Rex rabbits

Photoperiod	N	% Prime Total	% Prime Back	% Prime Front
10 continuous	5	45.4	43.8	48.9
12 continuous	5	55	52.4	58.9
14 continuous	5	57.8	59.4	56
10 intermittent	5	63.8	72.8	50.1
12 intermittent	5	62.6	57	71
14 intermittent	5	57.8	59.4	56
SEM		8.3	9.9	13.6
Continuous	15	52.6	51.5	54.6
Intermittent	15	61.5	63.3	58.6
SEM		5.2	5.5	11.3

Means were not different (P<.05)

Table 3 : Percentage of the total pelt prime area as found on the back and front of the pelt of three-month-old rabbits

Photoperiod	% of Prime on the Back	% of Prime on the Front
10 continuous	60.0^{xy}	40.0^{yz}
12 continuous	56.0^{xy}	44.0^{yz}
14 continuous	63.0^{xy}	37.0^{yz}
10 intermittent	75.6^{x}	24.4^{z}
12 intermittent	52.0^{xy}	48.0^{yz}
14 intermittent	63.2^{xy}	36.8^{yz}
SEM	7.8	7.8
Continuous	60.0^{a}	40.0^{b}
Intermittent	63.6^{a}	36.4^{b}
SEM	4.6	4.5

Means followed by different letters are different (P<.05)

The back represents about 60% of the total pelt area, and, as one might expect, it was found to contain significantly (P<.05) more prime area than the front for all treatments and for continuous versus intermittent lighting (Table 3).

The pelts of rabbits sacrificed at five months showed no difference statistically (P<.05) or by a non-statistical trend in favor of intermittent lighting stimulating prime (Table 4). As with rabbits at three months of age, the percentage of the entire pelt in prime was far greater on the back than on the front of the pelt (Table 5). The amount of the rabbit's fur in prime proved to be far greater at (P<.05) at five months than at three months (Table 6). This was likely to be expected, since the rabbit goes through three priming cycles beginning with baby prime (birth to 2.5 months), then intermediate prime (2.5 to 5 months) and finally senior prime (5 months onward) (CHEEKE, et al., 1987). Hence, from the third to the fifth month considerable change takes place in the nature of the hair growth as much of the hair passes from the catagen phase to the telogen or resting phase when senior prime is achieved.

Table 4 : Effect of intermittent and continuous lighting on the development of prime in five-month-old Rex rabbits

Photoperiod	N	% Prime Total	% Prime Back	% Prime Front
10 continuous	5	78.8	84.4	70.6
12 continuous	5	85.1	89.8	80.8
14 continuous	5	77.8	80.4	76.6
10 intermittent	5	87.5	88	85.2
12 intermittent	5	73.4	78.2	67.8
14 intermittent	5	89.4	90	89
SEM		7.2	5.6	7.7
Continuous	15	80.6	84.8	76
Intermittent	15	82.8	85.4	80.8
SEM		2.8	3.7	4.9

Means were not significantly different (P<.05)

Table 5 : Percentage of the total pelt area in prime as found on the back and front of the pelts of five-month-old rabbits

Photoperiod	% of Prime on the Back	% of Prime on the Front
10 continuous	64.4^{x}	38.2^{y}
12 continuous	63^{x}	37^{y}
14 continuous	61.8^{x}	38.2^{y}
10 intermittent	60.6^{x}	39.4^{y}
12 intermittent	63.4^{x}	36.6^{y}
14 intermittent	60^{x}	40^{y}
SEM	2.3	2.3
Continuous	63^{a}	37^{b}
Intermittent	61.3^{a}	38.6^{b}
SEM	2.1	2.4

Means followed by different letters are different (P<.05)

Table 6 : Effect of age and light regimen on the priming of Rex rabbits

Light	Age	Percent in Prime
Continuous	3 months	52.6^{b}
Continuous	5 months	80.6^{a}
SEM		3.7
Intermittent	3 months	61.5^{b}
Intermittent	5 months	82.8^{a}
SEM		4.4
Combined	3 months	57.0^{b}
Combined	5 months	81.7^{a}
SEM		2.9

Means followed by different letters are significantly different (P<.05)

Feed consumption, a parameter not studied in this trial, may shed some light on why prime may have been more evident at three months from intermittent lighting. UZCATEGUI and JOHNSTON (1991) have observed that the same intermittent lighting regimens, as used in this study, stimulated greater feed intake by fryer and adult lactating rabbits as compared to the continuous regimen results. Increased feed consumption may have a positive effect on hair growth. Later, during the onset of senior prime, the stress associated with the deprivation of feed may be needed to accelerate prime, as noted by Taylor and JOHNSTON (1984).

Unlike the observations of VRILLON et al. (1988), the shorter photoperiod did not accelerate prime for rabbits at either 3 or 5 months of age.

There may be some question as to the suitability of a five month period to induce prime. VRILLON et al. (1988) observed a compact winter pelt at 23 weeks but PETERSEN (1992) found pelts harvested at 8 months were superior to those at 6 or 7 months.

CONCLUSIONS

The degree of fur priming didn't appear to be related to the length of photoperiod (10-, 12- or 14-h) whether the light was given continuously or intermittently. At three months of age there was an indication that the intermittent regimens, which provided three light intervals of an hour each, may accelerate the priming process. By five months of age, however, the association between the limited light provided by skeletal photoperiods and prime no longer existed. Also, by five months of age the portion of the pelt in prime increased considerably over that observed at three months. Priming seems to follow a pattern that begins in the mid portion of the animal's back and belly and then progresses outwardly toward the sides.

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Efectos de Fotoperíodos Intermitentes y Contínuos de 10, 12 y 14 Horas en el Desarrollo de de la Fase Telegénica o de Descanso del Pelaje de la Variedad de Conejos *Rex* - Se condujeron pruebas experimentales para evaluar el efecto de fotoperíodos intermitentes y contínuos en el desarrollo de la fase de descanso del pelaje de la variedad de conejos *Rex*. Sesenta grupos de conejos *Rex* se dividieron en seis cuartos idénticos, con ambiente controlados, bajo los siguientes fotoperíodos: (1) 14L:10D; (2) 12L:12D; (3) 10L:14D; (4) 1L5.5D:1L:5.5D:1L:10D; (5) 1L:4.5D:1L:4.5D:1L:12D y (6) 1L:3.5D:1L:3.5D:1L:14D. Estos horarios simularon días subjetivos intermitentes y contínuos de 10, 12 y 14 horas. Los conejos fueron sacrificados a los tres y cinco meses de edad para evaluar su fase de descanso. No hubo diferencias estadísticas entre los tratamientos o métodos de iluminación aplicados a los conejos sacrificados a los tres meses. Sin embargo, hubo una tendencia de una mayor área de superficie en la fase de descanso cuando se aplicó iluminación intermitente. La fase de descanso fue más extensiva cuando se aplicó iluminación intermitente en el revés de la capa (63.3 vs. 51.5%), en el derecho de la capa (58.6 vs. 54.6%), así como también en la capa entera (61.5 vs. 52.6%). La fase de descanso, como porcentaje del área disponible, fue bastante similar tanto en la parte delantera como en la parte trasera de los conejos. Sin embargo, debido a que la parte trasera representa un 60% del área de superficie de capa, las partes traseras tuvieron un rendimiento de la fase de descanso significativamente mayor ($P < .05$) que las partes delanteras tanto bajo iluminación contínua (58.6 vs. 41.4%) como intermitente (61.8 vs. 38.2%). Las capas, de la prueba de 5 meses fueron similares en su fase de descanso como resultado de la iluminación contínua vs. intermitente (80.6 vs. 82.8%). El porcentaje de las capas en fase de descanso fue significativamente mayor ($P < .05$) a los cinco que a los tres meses (81.7 vs. 57%). La fase de descanso parece iniciarse en el medio del revés de la capa y extenderse hacia los lados. Se concluyó que la duración del día de luz (10, 12 o 14 horas) no tuvo un efecto apreciable en la promoción de la fase de descanso a los tres o cinco meses de edad. Iluminación intermitente puede estimular, hasta cierto punto, la temprana incidencia de la fase de descanso. Palabras claves: Fotoperíodo, fase de descanso, conejo *Rex*.
