

USE OF SIMULTANEOUSLY AVAILABLE ENRICHMENTS BY FARMED BLUE FOX (*ALOPEX LAGOPUS*)

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Abstract

This study was designed to establish which enrichments farm-born blue foxes (*Alopex lagopus*) prefer if several are simultaneously available in their home cage. A further aim was to clarify the extent to which a simple simultaneous comparison could replace more laborious methods. Until weaning, the experimental animals were housed with their mother and littermates in two-part shed cages (A and B). The two cages were connected via an opening in the walls between cages. Each two-part cage system contained a wire-mesh platform, a birchwood block, and a wooden nest box. Foxes preferred section with the nest box (section B) to the one with the sandbox (section A) ($P < 0.05$). The enrichment most commonly used was nest box ($P < 0.001$), and the one least used the wooden block; the usage rate of the sand floor and the platform was between these two. Use of the nest box remained stable in February and April, but was at a higher level in May ($P < 0.05$). Use of the platform increased steadily from February to May ($P < 0.01$) as did that of the sand box ($P < 0.05$). Use of the wooden block changed little during the study. The sandboxes tended to get dirty within 1–2 weeks, as the foxes defecated and urinated in them. The amount of stereotypy was low. Our findings tempt us to conclude that the present method with simultaneously available enrichments is an appropriate set-up for evaluating need for enrichments.

Key words: farmed fox, enrichments, housing environment, welfare, fur animal production

Continuous improvement of housing environments and management is essential for acceptable and profitable fur animal production (Korhonen et al., 2003, 2006). Recent changes in European fur animal welfare legislation have put pressures on farmers to seek tools to modify animals' farm conditions (European Convention, 1999; Ahola, 2002). Criticism has focused, in particular, on the monotonous housing environment of farmed furbearers such as fox and mink. Monotony here is considered as a lack of appropriate enrichments and insufficient opportunities to perform species-specific behaviour patterns.

Farmed blue foxes (*Alopex lagopus*) used to be raised in barren wire-mesh cages in sheds. Today, their cage environment has to be furnished with a netting platform and

an activity object made of wood (European Convention, 1999; Hovland and Bakken, 2000). Recently, provision of additional furniture such as sand floor, nest box and extra space has also been required. Until now, little research has been conducted to measure whether foxes value the resources suggested more than those already available. The value that farmed blue foxes place on these resources has been assessed in only a few experiments measuring the maximum price paid for and time spent on the resource (Koistinen et al., 2008 a, b). In these experiments, either one or several enrichments were available at a time. In our present study, all the enrichments were provided simultaneously, thus allowing us to compare the extent foxes actually chose to use each piece of furniture available. We can hypothesize that if this simple method yields the same result and conclusion as previous methods requiring hard work and effort, then we may in the future, too, apply the present method to clarify foxes' preference for enrichments.

Our aim here was to find out which enrichments foxes prefer if several are simultaneously available in their home cage. We further sought to establish the extent to which such a simple simultaneous enrichment comparison could be used instead of more laborious methods. The enrichments studied were earthen floor, a nest box, extra space, a platform and a chewing/activity object.

Material and methods

The experiment was approved by the Animal Care Committee of MTT Agrifood Research Finland (2005) and the study was carried out at the Fur Farming Research Station (MTT) at Kannus, Finland, (63.54°N, 23.54°E). The experimental animals were juvenile blue foxes born in May 2006. Until weaning, they were housed with their mother and littermates in two-part shed cages (A and B), each measuring 120 cm long × 105 cm wide × 70 cm high. The two cages were connected via an opening in the walls between cages (Figure 1). Each two-part cage system contained a wire-mesh platform (105 cm long × 25 cm wide) located at about 23 cm from the ceiling, a birchwood block (7 cm long × diameter 5 cm), a sandbox (80 cm long × 40 cm wide × 14 cm high), and a wooden nest box (40 cm wide × 70 cm long × 40 cm high) (Korhonen et al., 2004, 2006). When not frozen, the sand was replaced regularly (every 1–2 weeks).

The animals were fed by a commercial feeding machine. A single ration of freshly mixed fox feed was supplied once a day. The main ingredients of the feed were slaughterhouse offal, fish, fish offal and cereals, in accordance with the standard Finnish recommendations (Berg, 1986). Fresh water was available *ad libitum* from automatic watering devices.

When the cubs were 8 weeks old (July), the mothers were removed from the experimental litters. In mid-August, all littermates except two male cubs and one female cub were removed from each experimental cage set-up. In mid-September, one additional male was removed from each cage. Thereafter, a male-female pair was kept together in a cage until late February 2007 after which only a female was left in each cage set-up.

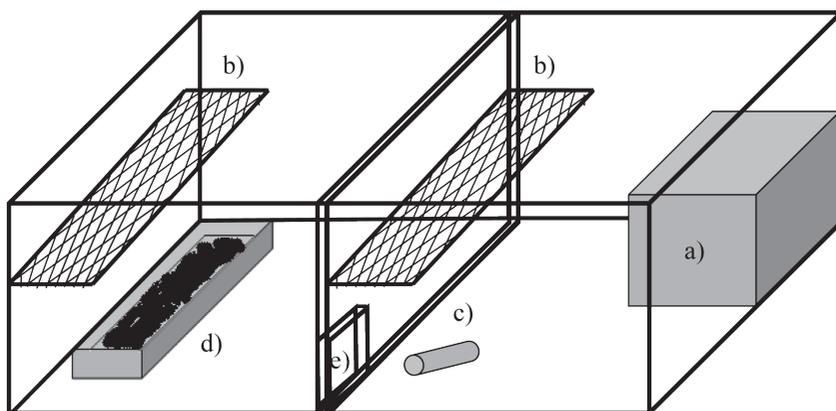


Figure 1. Layout of experimental set-up: (a) nest box; (b) wire-mesh platform; (c) wooden block; (d) sandbox; (e) opening between cage sections

The foxes' behaviour was video recorded three times during the experiment, i.e. in February when there was a male and female fox in the experimental cage, and in April and May, when only the female fox remained in the cage. The recording was made continuously from 10 a.m. to 8 p.m. with black-and-white video cameras (Computer FC-55) and time lapse video recorders (Hitachi VT-L2000E). The sampling interval was 5 min (cf. Jauhiainen and Korhonen, 2005).

Since the animals could perform a range of different activities while in the sandbox and in the nest box, interactions with the sandbox and nest box were analysed in greater detail.

Statistical analyses were conducted with SAS Enterprise Guide 3.0 program. The Univariate procedure was applied to test differences in use between sandbox and nest box cages (variable: difference in use of cages). The MIXED procedure was applied to test differences between months and separate enrichments.

Results

The use made of cage sections and various enrichments during February, April and May is shown in Table 1. Foxes preferred section with the nest box (section B) to the one with the sandbox (section A) ($P < 0.05$). The enrichment most used was the nest box ($P < 0.001$), and the one least used was the wooden block; the usage rate of the sand floor and the platform was between these two. Use of the nest box remained stable in February and April, but was at a higher level in May ($P < 0.05$). Use of the platform increased steadily from February to May ($P < 0.01$) as did that of the sandbox ($P < 0.05$). Little change was recorded in use of the wooden block during the study.

Table 1. Time budgets for studied cage sections and enrichments (% of the observations). Standard deviations (SD) are given in brackets. Cage section A included sandbox. Nestbox was located in section B (see Fig. 1). Wooden block was movable and therefore variably present in both sections. Originally it was placed in section B

Variable	February (♂ and ♀)	April (♀)	May (♀)
Cage section A	28.7 (19.8)	43.7 (16.9)	24.6 (26.9)
Cage section B	71.3 (19.8)	56.3(16.9)	75.4 (26.9)
Sandbox	5.0 (3.8)		11.3 (16.5)
Platform	2.7 (5.1)	6.5 (9.8)	24.6(21.9)
Nest box	24.5 (23.3)	27.9 (18.3)	46.4 (30.8)
Wooden block	0.2 (0.4)	0.4 (0.8)	0.3 (0.5)

The amount of digging, sniffing and contact with wooden block in the sandbox was low in both February and May (Figure 2), the animals spending most of their time during those months on other activities ($P < 0.05$). More lying in the sandbox was observed in May than in February. However, the sandboxes tended to get dirty within 1–2 weeks, as the foxes defecated and urinated in them.

The foxes used the nest box most commonly either for resting in or for lying on the roof (Figure 3). The next most common use was for performing some activity on the roof. Sniffing and scratching were very seldom observed. Lying on the roof increased as the spring proceeded, whereas other nest box activities did not change noticeably during the study.

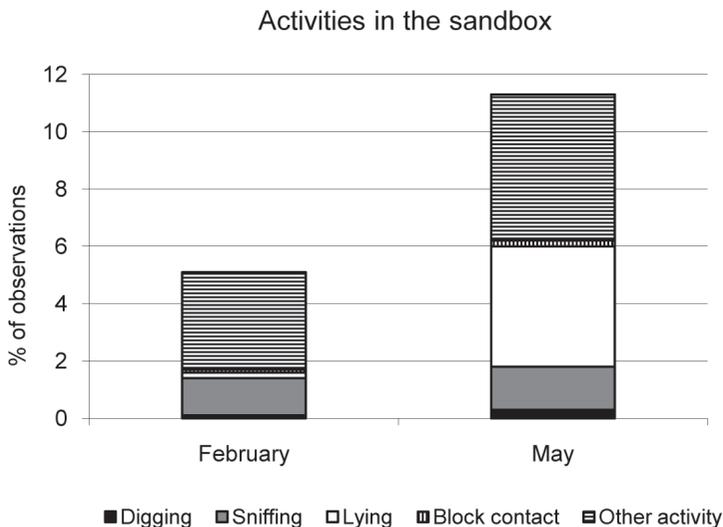


Figure 2. Behaviour of foxes in a sandbox (% of observations)

The amount of stereotypy was low, in February, April and May amounting to 0.2 (0.2), 3.19 (2.6) and 1.1 (0.7) min/h, respectively. Platform use was lowest in February, i.e. 2.9 (4.9) min/10 h, and highest in May (24.6 min/10 h; 20.9).

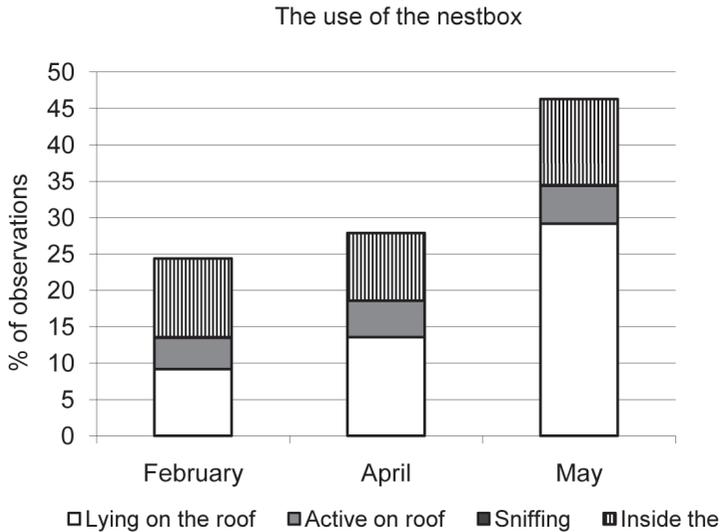


Figure 3. Behaviour of foxes in a nest box or on roof of nest box (% of observations). Scratching of the nest box cannot be shown, because it was observed only in 0.1% of May observations

Discussion

Our results are encouraging and provide us with some new elements for comparing animals' needs for enrichments. In previous experiments, when several enrichments were compared, problems were typically caused by seasonal changes and variation in time, as methods employed did not enable us to compare all the enrichments simultaneously. The results of such experiments are more difficult to interpret, and may even lead to false conclusions. With the method described here, we were able to compare use of all the enrichments at the same time and within the same time interval and thus to eliminate the variation that derives from an experimental set-up depending on time and season.

Preference tests comparing various enrichments have shown that farmed foxes do not choose only one enrichment, but use all those available but with variable preference (Hovland and Bakken, 2000; Harri et al., 2000, 2001). It is assumed that different enrichments and resources serve different behaviours and needs. The same preference pattern was observed in the present study.

The foxes preferred the section with the nest box to that with the sandbox. Indeed, the nest box was the resource most frequently used in this study. Winter/early spring is the coldest time of year in Finland, which may explain the high usage of nest boxes during that period, i.e. the foxes were seeking protection from the cold. Furthermore, May is typically whelping time for farmed foxes. The importance of the nest box is pronounced then, not only as a whelping place but also as watching nest box because of cubs inside (Korhonen et al., 2006).

Both the platform and the roof of the nest box serve as high places from which the foxes can observe their surroundings (Mononen et al., 1998; Hovland and Bakken, 2000). The foxes spent more time lying on the roof than on the platform even though there was a platform in both sections of the cage. Two reasons are postulated for this preference: one, the roof of nest box is larger than the platform and two, roof is made of wooden material but the platform of wire-netting platform. Undoubtedly wood is more pleasurable material to lie on than wire-netting.

The little use made of sandboxes does not encourage us to provide this enrichment for farmed blue foxes. The main reason why a sand floor has been demanded is that foxes are claimed to need substrate for digging (European Convention, 1999). However, digging was not very common behaviour, even when the foxes were in the sandbox. Thus, as shown by earlier studies (Korhonen et al., 2003), digging is not an important activity for farmed foxes.

The sandboxes get dirty within a week and yet it is almost impossible to replace the sand in winter. The sandbox is thus a difficult cage enrichment (Korhonen et al., 2003). We found here that foxes made greater use of the sandboxes for defecation than for resting.

Previous studies have shown that farmed blue foxes do not like resting on sand floor of any kind in autumn (Koistinen et al., 2008 a,b), but are willing to do so in spring. In the present study, the foxes rested in the sandbox around half of the time spent on the sand floor in May, thus supporting the findings of the earlier study. It would seem that the function of the sand floor changes with the season. It is feasible that foxes find the freezing sand floor in autumn an aversive resting site, but the newly melted sand in spring an inviting one.

The resource least used was the wooden block. This finding may, however, be partly due to the recording method: since foxes tend to use the wooden block for only very short periods at a time (Korhonen et al., 2002), our instantaneous sampling method may have failed to detect these short duration activities (cf. Martin and Bateson, 1986).

Wooden blocks have been found to reduce oral stereotypies because foxes can chew and carry them around (Korhonen et al., 2002). In this respect, the blocks may enhance animal welfare. Here, we noticed that foxes carried the wooden blocks around the two-part cage. They also placed the wooden blocks into the sandboxes every now and then. During cold periods, however, the blocks froze in the sand and so were difficult or impossible to move. The welfare implications of blocks during the coldest part of winter are therefore questionable.

We conclude that the present method employing simultaneously available enrichments is an appropriate set-up for evaluating the need for enrichments.

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References

- Ahola L. (2002). Effects of social and physical housing environment on the welfare in silver foxes (*Vulpes vulpes*). Ph.D. Thesis. Kuopio University Publications C. Nat. Environ. Sci., 145, 69 pp.
- Berg H. (1986). Rehutietoutta turkiseläinkasvattajille. Turkiseläintutkimuksia 23. Suomen Turkiseläinten Kasvattajain Liitto ry. Vaasa, 99 pp.
- European Convention (1999). Standing Committee of the European Convention for the Protection of Animals Kept for Farming Purposes (T-AP). Recommendation Concerning Fur Animals. The Standing Committee. Proc. 37th meeting, Strasbourg, 22–25.06.1999, 23 pp.
- Harri M., Kasanen S., Mononen J., Sepponen J. (2000). Preferences of farmed blue foxes for different floor types. Behav. Process., 49: 111–119.
- Harri M., Kasanen S., Mononen J., Ahola L., Sepponen J. (2001). Trade-off between floor level and floor material in farmed silver foxes. Behav. Process., 53: 87–95.
- Hovland A-H., Bakken M. (2000). The welfare situation of farmed foxes in relation to domestication status and compared to other farmed species. Agric. Univ. of Norway (NLH), Dept. of Anim. Sci., 88 pp.
- Jauhainen L., Korhonen H.T. (2005). Optimal behaviour sampling and autocorrelation curve: modelling data of farmed foxes. Acta Ethologica, 15: 13–21.
- Koistinen T., Mononen J., Korhonen H. (2008 a). Relative value of various resources to farmed blue foxes. Proc. 18th Nordic Symposium of the International Society for Applied Ethology, 16–18.01.2008, Oscarsborg, Norway, p. 7.
- Koistinen T., Jauhainen L., Korhonen H. (2008 b). Relative value of a nest box, sand floor and extra space during breeding season in adult blue fox males. MS.
- Korhonen H.T., Jauhainen L., Niemelä P., Sauna-aho R. (2002). Wooden blocks and straw as environmental enrichments for juvenile blue foxes (*Alopex lagopus*). Acta Ethologica, 5: 29–37.
- Korhonen H., Jauhainen L., Rekilä T. (2003). In-cage sandbox as a ground substitute for farmed blue foxes (*Alopex lagopus*): effects on digging and welfare. Can. J. Anim. Sci., 83: 703–712.
- Korhonen H., Rekilä T., Kivinen T., Jauhainen L. (2004). Comparison of hall and shed as housing environments for blue foxes. Scientifur, 28 (3): 7–10.
- Korhonen H., Jauhainen L., Rekilä T. (2006). Effects of year-round nestbox availability and temperament on welfare and production performance in blue foxes (*Alopex lagopus*). Ann. Anim. Sci., 6 (1): 149–167.
- Martin P., Bateson P. (1986). Measuring behaviour. An introductory guide. Cambridge University Press, London, UK, 200 pp.
- Mononen J., Korhonen H., Harri M., Kasanen S. (1998). A comparison of use of resting platforms and nest boxes in growing farmed silver foxes (*Vulpes vulpes*). Appl. Anim. Behav. Sci., 58: 383–396.

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Wykorzystanie dostępnych równocześnie dodatkowych elementów klatki przez fermowe lisy niebieskie (*Alopex lagopus*)

STRESZCZENIE

Celem doświadczenia było określenie preferencji urodzonych na fermie lisów niebieskich (*Alopex lagopus*) dotyczących wyboru dodatkowego, równocześnie dostępnego wyposażenia klatki oraz wyjaśnienie, w jakim stopniu proste doświadczenie porównawcze może zastąpić bardziej pracochłonne metody.

Do odsadzenia, zwierzęta doświadczalne utrzymywano z matkami i rodzeństwem z tego samego miotu w dwuczęściowych klatkach w pawilonach (A i B). Obie części klatki łączył otwór w ścianie. W każdej dwuczęściowej klatce znajdowała się półka z siatki, kloc z drewna brzozonego oraz drewniana skrzynka wykotowa. Lisy preferowały część klatki ze skrzynką wykotową (część B) od części, w której znajdowała się skrzynka z piaskiem (część A) ($P < 0,05$). Najczęściej używanym dodatkowym elementem klatki była skrzynka wykotowa ($P < 0,001$), najmniej używano drewnianego kłoca; stopień wykorzystania skrzynki z piaskiem i półki mieścił się pomiędzy tymi dwoma elementami. Użycie skrzynki wykotowej pozostawało na stałym poziomie w lutym i kwietniu, natomiast wyższe było w maju ($P < 0,05$). Wykorzystanie półki stopniowo rosło od lutego do maja ($P < 0,01$), podobnie jak wykorzystanie skrzynki z piaskiem ($P < 0,05$). Wykorzystanie drewnianego kłoca w trakcie doświadczenia nie uległo prawie żadnym zmianom. Skrzynki z piaskiem ulegały zabrudzeniu w ciągu 1–2 tygodni, w miarę jak lisy oddawały w nich kał i mocz. Ilość zachowań stereotypowych była niewielka.

Uzyskane wyniki pozwalają stwierdzić, że zaprezentowana metoda polegająca na równoczesnym udostępnieniu dodatkowych elementów stanowi odpowiednie narzędzie do oceny potrzeby dodatkowego umebrowania klatki.