Influence of dietary protein and carbohydrate supply on feed consumption and weight changes of mink dams and kits during the nursing period

Damgaard, B.M., Børsting, C.F. & R. Fink

An experiment including 172 female mink distributed on 4 experimental groups was performed from January until weaning in June. The females were 2 years old and of the colour type Scanbrown. The females were fed proportions of metabolisable energy (ME) from protein decreasing from 61 % to 39 % and ME from carbohydrates increasing from 1% to 25% and a constant energy level from fat (36 % of ME). The effects of differences in distribution of energy from protein and carbohydrates on the feed consumption and the mobilisation of body reserves of the females and the body growth of the kits were measured. The females had the same average daily energy consumption independent of the dietary concentration of energy and the distribution of energy. The females' mobilisation of body reserves during the lactation period was dependent on the number of kits. When they were fed an almost carbohydrate-free diet (1 % of ME) and a high content of protein, the females were apparently able to synthesise sufficient lactose for lactation without affecting the body growth of the kits. The dietary content of protein could be decreased from 61 % to 39 % of ME and replaced with carbohydrates without affecting the kits' body growth negatively.

Annual Report 1999, 81-84. 3 tables, 5 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Fatty acids/lecithin from rapeseed with a high content of natural vitamin E to mink bitches

Jensen, S.K. & B.M. Damgaard

The vitamin E activity of naturally vitamin E is considerable higher than the activity of synthetic vitamin E, but it is normally difficult and expensive to buy the natural form. However, rapeseed oil distillate obtained by refinement of rapeseed oil is very rich in natural vitamin E with a typical content of 8-9000 mg/kg. In order to increase the oxidative stability of this product it was formulated as a blend of distillate and rapeseed lecithin in a proportion of 45:55, and named **Lecithin+**. Thus the vitamin E content is over 4000 mg/ kg in this product. The vitamin E value of **Lecithin+** was investigated in an experiment with pregnant and lactating mink. The experiment showed that natural vitamin E was significant better transferred to the mink kittens through the mink milk compared with synthetic vitamin E. Furthermore, the experiment showed that there was only a marginal effect on the vitamin E status of the bitches and the kittens upon increasing the vitamin E content in the feed from 50 to 100 mg vitamin E/kg feed.

Annual Report 1999, 85-87. 3 tables. Danish Fur Breeders Research Centre, Holstebro, Denmark

Ammonium chloride fed to mink kits from June 10th to June 28th 1999

Clausen, T.N.

We investigated the consequences of adding 0.35 % ammonium chloride daily to mink feed from July 10 to July 26 on the growth of mink kits and urinary pH (Experiment I). Two groups, each consisting of 18 litters, with and without addition of 0.35 % ammonium chloride, were weighed at the beginning and at the end of the experimental period. Urinary samples were taken twice during the period. The growth of the male mink kits was reduced in the group that received 0.35 % ammonium chloride each day.

Furthermore, we investigated how an addition of 0.35 % ammonium chloride every second day would influence urinary pH and feed consumption (Experiment II). Twelve litters of wild type mink kits, were given feed which every second day contained 0.35 % ammonium chloride. Urinary samples were taken every day and feed consumption was measured. An addition of 0.35 % ammonium chloride every second day reduced the urinary pH on the day it was added, but feed consumption seemed to be reduced as well.

Annual Report 1999, 89-91. 4 tables, 4 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Phase feeding protein to mink in the growth period

Hejlesen, C. & T.N. Clausen

A reduced protein content in growth period feed from 29 to 24 percent of ME has no consequence on skin length or fur quality on mink of colour type Wild mink. The best date for a reduction is not definitively defined. However earlier test strongly indicates that it is in late September. In this experiment a reduction on 20. September has been investigated, with mink of colour type Standard.
It is concluded, that a reduction in protein content from 29 to 24% of ME on 20. September is recommendable.

Annual Report 1999, 93-95. 2 tables, 4 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Increasing amounts of capelin in the feed for mink kits in the growing-furring period 1998

Clausen, T.N. og C. Hejlesen

Investigation on the use of 0, 4, 8, 12 % capelin and 12 % capelin with an addition of 0.2 % Hemax (Fe) in the feed for mink kits in the growing-furring period. 4 groups with 81 male- and 81 female- kits and the control group with 162 male- and 162 female-kits were used. 12 % capelin could be used in the feed without negative consequence on weight of the kits, size of the pelt, pelt quality and hematocrit.

Annual Report 1999, 97-9. 4 tables, 1 fig., Danish Fur Breeders Research Centre, Holstebro, Denmark.

Increasing amounts of toasted soybean for mink kits in the growing-furring period 1998

Clausen, T.N. & C. Hejlesen

To the investigation we used 3 groups each consisting of 81 male- and 81 female- wild type mink kits fed 4, 8 or 12% toasted soybean, and a control group with 162 male- and 162 female wild type mink kits fed a control diet without toasted soybean. The use of 8 - 12% toasted soybean in the growing period, reduced the growth of mink kits from start of the investigation until September 20. At pelting there were no significant difference between groups, but a decrease in weight with increasing amount of toasted soybean in the feed was seen. The pelt length was reduced (though not significant) if the feed contained 12% toasted soybean. The content of toasted soybean in the feed should not exceed 4 - 8% in the growing-furring period.

Annual Report 1999, 101-103. 2 tables, 2 figs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Two levels of toasted soybeans to replace fish products in the feed for mink kits in the growing-furring period 1998

Clausen, T.N. & C. Hejlesen

Investigations on the use of reduced amounts of fish offal and industrial fish in the feed for mink kits in the growing-furring period. Two experimental series each reducing the amount of fish offal and industrial fish from 32,5 % to 27,5 - 22,5 - 17,5 - 12,5 - 7,5 and 0% were used. In one of the investigation series the fish was replaced by a dry protein mix with a low content of toasted soybean, in the other series the fish was replaced by a dry protein mix with a high content of toasted soybean. To the investigation 2 x 7 groups of 81 male- and 81 female- mink kits were used. All feed mixtures contained 10 % fish silage.

The results showed that it is possible to reduce the content of fish offal and industrial fish in the feed for mink kits in the growing-furring period to 12,5%, without negative consequences for skin size and quality, but the dry protein mix replacing the fish should not contain higher amounts of toasted soybean than would result in a final content of toasted soybean in the feed mixture of around 6 %.

Annual Report 1999, 105-110. 9 tables, 4 figs., Danish Fur Breeders Research Centre , Holstebro, Denmark.

Swine pulp to mink in the growth-furring period

Hejlesen, C. & T.N. Clausen

Swine pulp comprising swine spines, toes and heads was introduces as a new feed stuff for mink feed. Palatability of growth period diet is not effected by up to 11% swinepulp, but consequences of using swine pulp in the entire growth period has not been examined until now.

Four groups each consisting of 81 scanglow males was provided either 0, 4, 8 or 12% swine pulp in the diet from July until pelting.

In the experiment, up to 12% swine pulp in the growth period diet, had no effect on weight gain from July until pelting, skin length, fur quality or frequency of low grades.

Annual Report 1999, 111-113. 2 tables, 4 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Palatability of 11% swine pulp in growth period feed for mink

Hejlesen, C.

Addition of 7.5% swine pulp comprising swine toes, spines and heads in growth period feed has a neutral tending to positive palatability effect. Eight percent swine pulp is already use in the feed, and therefore palatibility effect of 11% swine pulp was investigated.
A preference test with two groups of 9 adult standard male mink was initiated. The duration of the test was 4 weeks - two weeks where each animal had unrestricted access to both the control diet without swine pulp and the test diet with 11% swine pulp. - and two weeks with unrestricted access to either the control or test diet.
In conclusion, 11% swine pulp in growth period feed had a positive effect on the palatability of the feed.

Annual Report 1999, 115-117. 5 tables, 3 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Different Protein Supply to Mink Kits in the Growing Period. Nitrogen, Energy, Water and Mineral Balance

Einarsson, E.E. & N.E. Hansen

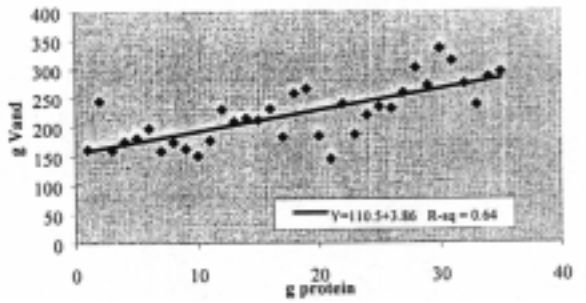

Fig. 4. Correlation between grams of absorbed raw protein and total consumed amount of water (drinking water and water in feed) for all animals during the entire growth period.

In the present study, the dietary protein requirements of mink throughout the growth period, was determined in three groups of 4 standard male mink kits. The diet consisted of 25% (LP), 40% (MP) and 60% (HP) of the metabolizable energy from protein. The experiments were conducted as N-balance trials. At three times during the experiment diet- and water intake and also faeces-/urine excretion was collected and measured. Each collection period lasted for a period of 7 days.
The level of protein in the diet does not have an effect on the digestibility of protein as the kits had full digestibility throughout the whole experiment. The different energy concentrations in the diets had a clear effect on the total absorption of the diets and therefore total energy absorption. The consumption of ME was not different between experimental groups but it decreased during the growing period. The reason for this difference in energy utilization, was the demand for the excretion of the “extra” nitrogen through urine, and the energy demand for the transformation of protein to energy. At the start of the growth period, the utilization of protein to energy was higher than in the end, for fat this was in the reverse i.e. over the growing period the utilization was increased. Water intake and excretion rose with increased protein level in the diet, as expected due to the strong requirement of water for the excretion of nitrogen in urine. The high water requirement was satisfied with water in the diets. The

digestibility of minerals was not affected by dietary protein level. The digestibility of Ca, P and Mg decreased during the period, in accordance with the amount deposited in the body and the decreased digested volume. Never the less, concentration of minerals in faeces increased and decreased in urine. Protein as an energy source in diets is an expensive store of energy and increases diet and water absorption. Fat as an energy store gives a better energy utilization in metabolism of diet, however body dissection revealed a tendency for a fatter liver in the LP group. The results therefore show that a diet composed 25% of ME from protein is too low and high protein concentration leads to decreased utilization of protein and energy.

Annual Report 1999, 119-127. 2 tables, 4 figs., 11 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Analysis of Fat from Wild- and Farm Mink Using Supercritical Fluid Extraction (SFE) and Supercritical Fluid Chromatography (SFC)

Asferg, T., Buskov, S., Clausen, T.N., Hammershøj, M., Mortensen, K. & H. Sørensen

SFE and SFC-methods of analyses for identification of the lipid-profile in subcutaneous fat from mink are effective and relatively simple. Preliminary results show influence of the animal food on the fat-profile in the subcutaneous mink-fat. Apparently, fat-profiles can be used to distinguish farm mink from wild mink. However, there is a need to clarify what factors influences the triacylglycerol-profile in the subcutaneous fat before this profile can be used as an indicator for the duration of the period, the mink have been living in the nature. It is relevant to continue the lipid research, including investigation of other lipids like membrane lipids. This will be of importance, also in connection to other problems with fur animals, especially nutritional physiology, feed quality, effect of mink milk on the health and development of mink puppies, feed related illness problems, lipid rancidity, and fur quality.

Annual Report 1999, 129-134. 5 figs., 12 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Analysis of mono-, di- and oligosaccharides in biological materials

Andersen, K.E., Bjergegaard, C., Mortensen, K., Møller, P. & H. Sørensen

The present work has resulted in development of two analytical methods for determination of reducing and non-reducing carbohydrates, respectively, in various biological materials. Sample preparation, which is common for the two groups of compounds, has comprised extraction and ion chromatograpy with use of the resulting water effluent for analysis by HPCE. The reducing carbohydrates were derivatised by tryptamine in order to improve UV-absorption, before analysis in a MECC system (Micellar Electrokinetic Capillary Electrophoresis) in borate buffer with cholate included as surfactant. The non-reducing carbohydrates, which cannot be derivatised due to lack of a "free" carbonyl group, were analysed in a FZCE system (Free Zone Capillary Electrophoresis) in borate buffer with 2,6-dicarboxylsyre (PDC) as chromophor, and detection by indirect UV.

The methods developed were used for determination of the quantitatively most important low molecular weight carbohydrates in barley, malt and mash. The results showed the highest content of carbohydrates in malt (germinated barley), with sucrose as the dominating components (25,1 g/kg). The level of glucose and maltose in malt was high compared to barley, indicating activation of the starch degrading enzyme α-amylase under the germination process. Equivalent to this, the high content of the disaccharides: cellobiose and melibiose in malt compared to barley may be explained by activation of β-glucanase and β-fructofuranosidase. Mash, which is obtained after ultrafiltration of malt, had as expected a relatively low level of low molecular weight carbohydrates.

Lupin and pea, which is potential alternative protein-sources for mink, as are the analysed products based on cereals, had a relatively high content of the α-galactosides sucrose, raffinose, stachyose, and verbascose. Compared to the content of α-galactosides in pea, the level in lupin is generally higher, whereas in cereals, the level of α-galactosides is lower.

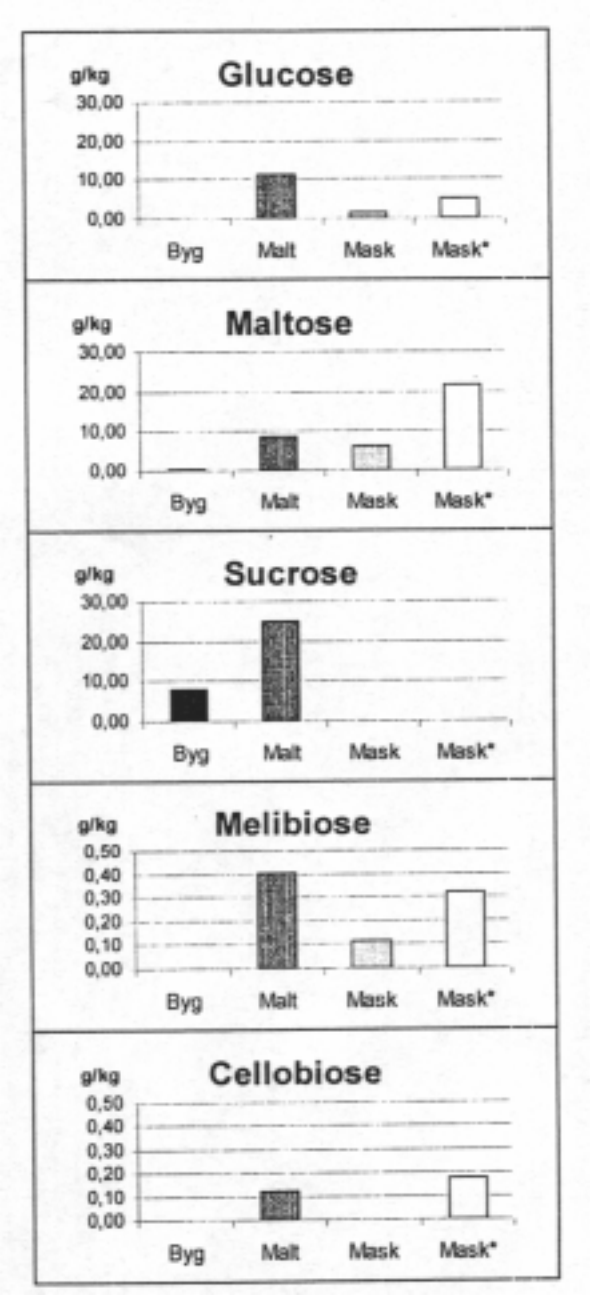

Fig. 5. Content of selected monosaccharides and disaccharides in barley, in malt mash and mash* analysed by capillary electrophoresis.

In conclusion, the developed methods are effective and relative simple with good potentials for quantification of reducing and non-reducing carbohydrates, respectively. The methods have been used on biological plant material as barley, malt, mash, lupin and pea, but may also be applicable to oligosaccharides in milk and other animal based material. The developed methods supplements each other well, as the non-reducing carbohydrates can not be analysed in the system for determination of reducing carbohydrates, whereas the reducing carbohydrates gives broad peaks being difficult to quantify in the system for non-reducing carbohydrates.

Annual Report 1999, 135-144. 1 table, 7 figs., 17 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Investigation of proteins and peptides in mink milk

Bjergegaard, C., Clausen, T.N., Mortensen, K., Sørensen, H., Sørensen, J.C. & S. Sørensen

Methods of analysis for determination of individual proteins and peptides in small volume (0.1-1 ml) of mink milk have been developed. Initially supercritical fluid extractions (SFE) following lipophilisations were used as fast and gentle methods to lipid extraction and disruption or break of the milk micelles or emulsions. Group separations of the proteins were then performed by use of IsoPrime™ techniques, which allowed separations of the proteins and peptides according to their pI-values. Slab gel electrophoresis, IEF and SDS-PAGE, were used for evaluation of pI and subunit molecular weight (MW) of proteins. These methods of analyses were, however, unable to give sufficient high resolution for distinguishing between the great number of individual proteins in the milk, and these techniques were also unable to detect the peptides of interest with MW < 5-6 kD. Micellar electrokinetic capillary chromatography (MECC) was therefore developed for determination of the individual proteins and peptides in milk. Comparison of the content of proteins in milk from mink and in milk from other animals, including human milk, revealed appreciable differences. Correspondingly, appreciable differences were found when the protein content in colostrums was compared to that in milk from different times of the nursing period.

Annual Report 1999, 145-153. 1 table, 4 figs., 14 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Glycosides in mink milk

Andersen, K.E., Bjergegaard, C., Buskov, S., Clausen, T.N., Mortensen, K., Sørensen, H., Sørensen, J.C. & S. Sørensen

Milk from mink has a very special composition and amount of different types of glycosides-/carbohydrates. Lactose is not the quantitatively dominating carbohydrate, as is the case in milk from several other animals, especially cows. Up till 16 different glycosides have been demonstrated in mink milk, generally oligosaccharides of 4-6 monosaccharide units, with N-acetylglucosamin and 2-α-L-fucose as typical constituents. 2-α-L-fucosyl-D-galactopyranosyl-β-(1-4)-D-glucopyranose (2-α-L-fucosyllactose) is thus among the quantitatively dominating glycosides identified. The carbohydrates in mink milk also calls for attention due to an apparent structural similarity with the glycosidic parts of membrane components, glycolipids, and glycoproteins, including immunoglobulins and glycoproteins that are the structural determinant of blood type. Mink milk has moreover "colostrum appearance" for a relatively long part of the lactation period.

The analysis of mink milk samples is based on a newly developed technique, allowing work with the relatively small sample amounts of mink milk generally available. Especially important for success with these analyses is the opportunity to break the emulsion of the milk, that is degradation of the micellar structure, by gentle extraction of fat/lipids with supercritical fluid extraction (SFE). Group separation then follows, prior to analytical determination of the individual glycosides by capillary electrophoresis (HPCE/MECC). The analysis for mink milk glycosides has thus comprised three different HPCE methods. The identification of glycosides has been based on relatively advanced 1D- and 2D-NMR analysis of preparative purified glycosides.

Annual Report 1999, 155-161. 7 figs., 11 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Proteinsynthesis in mink skin - measurements from skin samples taken from paws of production animals

Riis, B.

Protein synthesis is of immense importance to the fur producers, because a dried skin consists of 80-85% protein. Perfect quality of the skin requires perfect protein synthesis and strict regulation of the process. Measuring protein synthesis rates are usually neither technically easy nor cheap. Here this parameter is estimated by using an indirect way to measure the skin protein synthesis. The method is based on the measurement of the content of ADP-ribosylatable translational elongation factor-2, eEF-2, The rationale for this indirect measurement is that this enzyme participates in the synthesis of all proteins, including itself. Here it is shown that protein synthesis rates can be measured both on skin samples from front paws of production animals, and on samples taken from the back of the mink skin. Furthermore, it is shown that the paws must be frozen within 1 hour in order to avoid degradation of the sample. Combined this show that it is possible to test large number of samples from production animals without any major effort from the farmer – and without any economical loss, because the unharmed skin can be sold at the auction.

Annual Report 1999, 163-167. 5 figs., 9 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Oxidation damages in tanned mink skin. Influence of scrabing and storage time before tanning

Santin, I., Andersen, S. & V. Weiss

Oxidation of fat on the leather side of mink skins is a problem because it reduces their usability. The influence of the fleshing process and time of storage from drying to dressing were investigated. On 3 farms, all receiving feed from the same feed kitchen, 300 male mink (wild mink or mahogany) on each farm were selected in November 1998. After killing, these mink were weighed, marked and divided into

3 groups. Mink from group 1 were fleshed and dried on the original farm, while these from group 2 and 3 were fleshed and dried on the 2 other farms. The 3 groups from each farm were hereby fleshed on 3 different machines, which resulted in variation in the quality of the fleshing. After drying the skins were sent to the Copenhagen Fur Centre. At the Copenhagen Fur Centre each group was further divided into 3 groups, which were sent for dressing on January 4, April 26. and September 7, 1999 respectively. After dressing the skins were evaluated for oxidation damages on the leather side. The investigation shows, that the fleshing process had a great influence on the extent of oxidation damage - there were almost no oxidation damages in skins, which were fleshed well. Storage time from drying to dressing also had an influence. The skins sent for dressing on the 4th of January were nearly all free from oxidation damage. Good fleshing combined with correct storage can reduce the problem of fat oxidation on the leather side of mink skins, and increase the usability of the skins.

Annual Report 1999, 169-173. 7 tables. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Ethoxyquin in the feed for mink kits in the growing-furring period

Clausen, T.C. & H.H. Dietz

The addition of Ethoxyquin in the feed for mink kits in the growing-furring period was investigated. The investigation group consisted of 81 male and female wild type mink kits and the control group consisted of 162 male and female wild type mink kits. The results showed that the use of 167 ppm Ethoxyquin significantly reduced the kit weight in September, but at pelting in November, the difference was not significant. The pelts in the control group were 1.2 cm longer than in the experimental group (p=0.08), and the relative weight of the kidneys and livers, were slightly higher in the experimental group compared to the control group (not significant). However there was a tendency towards more pronounced changes in the liver and kidneys of male mink kits fed a high level of Ethoxyquin compared to the control group.

Annual Report 1999, 175-177. 4 tables, 4 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

***E. coli* infection in mink**

Vulfson, L., Pedersen, K., Dietz, H.H. & T.H. Andersen

Escherichia coli is a common finding in outbreaks of diarrhoea in mink during the production season although their role as primary causal organisms remains unclear. Few investigations of *E. coli* isolated from mink with diarrhoea have been conducted. The present study was undertaken to determine the serotypes and antimicrobial susceptibility of *E. coli* isolates from healthy and diseased mink. On 6 different farms, rectal swabs were taken from healthy and diseased animals, once at the outbreak of disease and again approximately 2 weeks later. The swabs were subjected to bacteriological investigation, and a total of 210 *E. coli* were isolated, 98 from healthy animals and 112 from diseased. All isolates were serotyped and subjected to MIC determination to 12 antimicrobial compounds. One hundred and forty seven isolates were haemolytic, whereas 63 were non-haemolytic. Both haemolytic and non-haemolytic strains were isolated from healthy as well as diseased animals. A large number of serotypes were detected, the most frequent being O2, O6 and O25, but occurrence of diarrhoea was not associated with the presence of specific serotypes. All isolates were resistant to tylosin and lincomycin, and sensitive to enrofloxacin, neomycin, gentamicin and colistin. For tetracyclin, amoxycillin, ampicillin, sulfamethoxazol, and trimethoprim, considerable variations in susceptibility were found among the 6 mink farms, resistance of *E. coli* strains ranging from 0 to 57.7%. Furthermore, resistance to these compounds was approximately 50% more abundant among haemolytic strains than among non-haemolytic.

Annual Report 1999, 179-186. 7 tables, 19 refs. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Test of finely-meshed wire on the nest box in the period May-June 1998

Sørensen, K. & U.L. Rasmussen

A trial was performed using two different wire mesh sizes on the lid of the nest box. Type 1 was mesh size, 1”x 1” used in the control group, and type 2

was mesh size ¾”x ¾”, used in the trial group. Both types were Bezinal galvanised.

There were no differences between the two groups in relation to total biomass gain of the mink kits, nor in the parameters used at the time of selection of breeding animals. There was a tendency towards lower kit weight gain and higher weight loss in the females in the trial group.

The trial conditions were not optimal and a final conclusion is therefore somewhat uncertain. It is recommended that the trial be repeated.

Annual Report 1999, 187-189. 8 tables. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Test of finely-meshed wire on the nest box in the period May to June 1999

Rasmussen, U.L.

A trial was performed using two different wire mesh sizes on the lid of the nest box. Type 1 was mesh size, 1”x 1” used in the control group, and type 2 was mesh size ¾”x ¾”, used in the trial group. Both types were Bezinal galvanised.

There were no differences between the two groups in relation to total biomass gain of the mink kits, nor in the parameters used at the time of selection of breeding animals. There was a tendency towards lower kit mortality, lower kit weight gain and higher weight loss in the females in the trial group.
There are both advantages and disadvantages when changing to a smaller mesh size. This trial confirms the tendencies found in the trial in 1998.

Annual Report 1999, 191-193. 9 tables. Danish Fur Breeders Research Centre, Holstebro, Denmark.

Genomic Map for Mink

Christensen, K.

Annual Report 1999, 195-196. Danish Fur Breeders Research Centre, Holstebro, Denmark. Only title received.