The effectiveness of belmin in feeding of female arctic foxes (Vulpes lagopus L.) to increase reproductive functions

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Abstract. The article presents the results of tests of protein-organic additives on pregnant female Arctic foxes. The criteria for assessing the impact on the productivity of females of arctic fox and the number of missing, poor and disadvantaged females gave birth, fertility, the number of mothers who are good reproduction, number of stillborn puppies, preservation of offspring before registration and the number of puppies in terms of the main female. During the experiments, it was found that the inclusion in the number of pregnant females should be 1.5 grams per day, which leads to a decrease in the number of stillborn puppies and, with, as a consequence, an increase in the number of young animals to be deposited.

1. Introduction
Modern technologies make it possible to obtain new feed additives with exceptional properties that are aimed directly at optimizing metabolic processes in animals. Organoelement compounds of macro- and microelements, which are characterized by active absorption in the digestive tract and rapid involvement in metabolic processes, should be referred to such biologically active substances. At the same time, a significant advantage of such substances is the possibility of a significant reduction in the norms of their entry into diets in comparison with conventional additives of mineral salts.

At present, organic forms of trace elements are used to increase the productivity of cows [1], horses (pigs [2], poultry [3] and fish [4]. Directly in fur farming, such complex microelement preparations as hemovit, helavit, seledant, and sel Plex ferropeptide-2, bio-iron feed, etc. [5].

At the Department of Animal Feeding MGAVMiB-MVA them. K.I. Scriabin obtained and already tested on poultry, pigs and lactating cows, an organic complex of vital trace elements - Belmin. According to these studies, its high efficiency for increasing the productivity of farm animals has been shown [6,7,8]. Given this, of undoubtedly scientific and practical interest is the determination of the possibility of using Belmin in fur farming, including on pregnant females of fur-bearing animals.

2. Materials and methods
Organoelement compound Belmin is a proteinate of trace elements associated with amino acids and small fragments of protein molecules (peptides). Belmin is a gel-like translucent substance prepared according to a special recipe and technology in laboratory conditions based on known protein sources and a set of vital mineral elements (Co, Cu, Fe, Zn, K, I, Mn, Se), the qualitative and quantitative composition of which can be changed depending on the tasks.
To study the possibility and evaluate the effectiveness of using the silvermin protein-mineral complex belmin in the feeding of pregnant females of silver fox at the Saltykovsky Breeding Animal Farm (Moscow Region), a scientific and economic experiment was carried out previously, and then, next year, a production test of the drug. Animals for scientific and economic experience (females of silver fox at the age of 3 years) were selected on the basis of analogues, during the production check, the age of the females was not taken into account. Schemes of scientific, economic and industrial tests are presented in table 1.

In accordance with the experimental design, females of the experimental groups from the beginning of the rut to the whelping daily, in addition to the main diet, received microelements of various origins: belmin and inorganic salts (scientific and economic experiment), or only belmin (production test).

The preparation Belmin and mineral salts: FeSO4 · 7H2O, CuSO4 · 5H2O, ZnSO4 · 7H2O, CoSO4 · 7H2O, MnSO4 · 5H2O, KJ, Na2SeO3 were introduced into the feed mixture by the method of stepwise mixing immediately before feeding. For the uniform introduction of additives of biologically active substances and inorganic salts into the feed, they were pre-mixed with an inert carrier (wheat bran), which was added in equal amounts to the diet of animals of all experimental groups.

All animals selected for the experiments were in the same conditions and received a diet in the structure of which meat and fish feeds comprised from 72.2 to 79.4%, milk - from 2.1 to 5.2%, and cereals - from 19.8 to 21.7%, succulent feed (vegetables) - from 0.5 to 0.9%. The composition of the main diet during pregnancy changed slightly.

During the experiments, animals of the I group, receiving only the main diet, were the control. From the data presented in table 1, it can be seen that with the same caloric content of the feed mixture, in comparison with the recommended ratios of nutrients, the average content of digestible protein, fat and carbohydrates in the diets of females of the main herd corresponded to the recommended norm [9].

| Production group | Period | Digestible protein | Digestible fat | Digestible carbohydrates |
|------------------|--------|--------------------|----------------|-------------------------|
| Pregnant females | March-May | 3.2-3.7 | 33 | 3.8-6.2 |
| *Recommended nutrient ratio in the diet of female Arctic foxes* [10] |
| Pregnant females | March-May | 10-11 | 47 | 19 |
| *The actual ratio of nutrients in the diet of female Arctic foxes (scientific and economic experiment)* |
| Pregnant females | March | 10.6 | 48 | 3.7 | 34 | 4.3 | 18 |
| April | 10.6 | 48 | 3.6 | 33 | 4.6 | 19 |
| May | 10.7 | 48 | 3.5 | 33 | 4.6 | 19 |
| *The actual ratio of nutrients in the diet of female Arctic foxes (production tests)* |
| Pregnant females | March-May | 10.4 | 47 | 3.7 | 34 | 4.5 | 19 |

Since the true need of pregnant Arctic fox females for micronutrients has not been determined, when normalizing their dose, we were guided by previously obtained data on the use of micronutrients in feeding the fox [11, 12], a type of closely related fox. For this reason, females of group II were fed belmin at the rate of 1.5 g per head / day. (trace element content, mg: Co - 0.068; Cu - 0.006; Fe - 7.594; I - 0.012; Mn - 0.106; Se - 0.006; Zn - 1.029).

For animals of group III, the norm of giving belmin was 3 g per goal / day. (trace element content, mg: Co - 0.136; Cu - 0.012; Fe - 15.188; I - 0.024; Mn - 0.212; Se - 0.012; Zn - 2.058).

Females of the IV experimental group received inorganic mineral salts as an additive, which, in terms of the number of trace elements, was mg / g/d (Co - 0.230, Cu - 0.020, Fe - 25.820, I - 0.040, Mn - 0.360, Se - 0.022, Zn - 3.500 (Table 2).

According to the results of scientific and economic experience, the optimal concentration of belmin was determined and a production test was carried out on pregnant females of the Arctic fox (Table 2).
Table 2. Scheme of scientific and economic and production experiments

| Group | Number of animals (head) | Micronutrient supplementation |
|-------|--------------------------|-------------------------------|
| I     | 7                        | The main diet (RR)            |
| II    | 7                        | RR + belmin 1.5g /head/day.   |
| III   | 7                        | RR + belmin 3.0g / head / day.|
| IV    | 7                        | Inorganic salts of microelements |

Scientific and economic experiment

Production check

I 96 The main diet (RR)
II 137 RR + belmin 1.5g /head/day.

3. Results

According to the results of the scientific and economic experiment, it was found that the relatively best values for the exit (registration) of young animals to the main female were in the II and III experimental groups, with different rates of input of belmin - 1.5 and 3 g per 1 goal. per day did not have a significant effect on this indicator (Table 3). Somewhat inferior in reproduction to groups of females with belmin, animals received mineral salts with food. However, for all analyzed indicators of the reproductive ability of female foxes, the difference between the groups was unreliable.

Table 3. The results of whelping of female Arctic foxes (scientific and economic experience), M + m

| Indicators                      | Group       |
|--------------------------------|-------------|
| Total females (head)           | I II III IV |
| Missed Females                 | 7 7 7 7    |
| Dysfunctional Females          | - - - -    |
| Female deaths                  | - - - -    |
| Whelp females                  | 7 7 7 7    |
| Puppies were born              | 99 91 98 92|
| Living                         | 91 90 91 85|
| Dead                           | 8 1 7 7    |
| Puppies death before registration | 14 11 12 5 |
| Fertility                      | 13.71±0.891 13.00±1.155 14.0±0.951 13.14±1.468 |

In terms of basic female flocks

| Indicators                      | Group       |
|--------------------------------|-------------|
| Stillborn puppies              | 1.14±0.459 0.14±0.143 1.0±0.690 1.0±0.845 |
| Puppies death before registration | 2.0±0.787 1.57±0.481 1.71±0.565 0.71±0.360 |
| Registered puppies (access to the main female) | 10.57±0.841 11.29±1.169 11.29±0.522 11.23±1.325 |

Accordingly, when choosing the optimal dosage of belmin for pregnant female Arctic foxes, we proceeded from an assessment of a set of indicators: the number of females who missed and dysfunctionally gave birth, fertility, the departure of puppies before registration, etc. (table 3), which differed unreliably from each other. Only in animals of experimental group II (1.5 g of belmin per
head/day), the average number of stillborn puppies was 0.14 goals per female, which is significantly, by 87.72%, less compared to the control (1.14).

This determined the choice of the indicated concentration of the drug for the production test. According to the results of which (table 4), it can be seen that although the puppies in the main female increased by 6.1% in the group with belmin (8.93 in the experiment versus 8.42 in the control), this deviation was not significant.

Subsequent accounting of the number of females without offspring with a breakdown of losses (missed and dysfunctional), fertility, and other reproduction rates also did not reveal significant differences between the control and experimental groups (table 4).

| Indicators                                | Group   |
|-------------------------------------------|---------|
| Total females (head)                      | I       | II      |
| Missed Females                            | 8       | 13      |
| Female deaths                             | 2       | 1       |
| Dysfunctional Females                     | -       | 1       |
| Whelp females                             | 88      | 122     |
| Puppies were born                         | 1054    | 1513    |
| Living                                    | 958     | 1436    |
| Dead                                      | 96      | 77      |
| Puppies death before registration         | 150     | 213     |
| Fertility                                 | 11.98±0.427 | 12.40±0.305 |

In terms of basic female flocks

| Indicators                                | Group   |
|-------------------------------------------|---------|
| Stillborn puppies                         | 1.00±0.213 | 0.6±0.085* |
| Puppies death before registration         | 1.56±0.185 | 1.55±0.196 |
| Registered puppies (access to the main female) | 8.42±0.465 | 8.93±0.385 |

Note: * significance level - p <0.05.

Moreover, the effect of the drug allowed significantly (by 44%), with a significant difference (p <0.05), to reduce the number of stillborn puppies in the group using belmin, which, taking into account the practically identical safety of young animals before registration (the average departure of puppies in terms of female: group I - 1.56; group II - 1.55 goals.) and almost similar fecundity (group I - 11.98 and group II - 12.40), allowed to ensure a stable, in comparison with the control, predominance of puppies to registration.

4. Conclusion

Moreover, the effect of the drug allowed significantly (by 44%), with a significant difference (p <0.05), to reduce the number of stillborn puppies in the group using belmin, which, taking into account the practically identical safety of young animals before registration (the average departure of puppies in terms of female: group I - 1.56; group II - 1.55 goals.) and almost similar fecundity (group I - 11.98 and group II - 12.40), allowed to ensure a stable, in comparison with the control, predominance of puppies to registration.

In particular, recommendations were developed on the use of sodium humate in adult pregnant female mink. The total duration of its use was 60 days before whelping, the daily dose of the drug was
15 mg / kg of female body weight. Feeding sodium humate contributed to an increase in the offspring yield by 21%, while the resulting offspring had a more active growth [14].

When using the hemovit-m preparation with Mn, not only intensive growth of young minks and improvement of protein digestibility were noted, but also an increase in the reproductive ability of females, which manifests itself in an increase in the puppies' yield to the main female for registration [15]. The use of Sel-Plex, a chelating compound of selenium with methionine, had a positive effect on the milk production of female minks [16]. According to the results of the use of Bio-Iron with microelements and ferropeptide, unreliable, but significant deviations were found for individual indicators of the reproductive ability of female sables. In particular, Bio Iron contributed to an 8.1% decrease in female skipping in relation to the control group [17], while the ferropeptide increased the yield of sable puppies by 18.3% [18].

In addition to increasing the productivity of fur animals, the advantages of organoelement compounds include the possibility, in comparison with sulfate salts of metals, to significantly reduce the rate of decay of vitamins used with them. In addition, trace elements such as selenium, cobalt and iodine, which are unstable in mixtures, are most stable in the chelate form.

So, a positive significant effect (p <0.05) in reducing the number of stillborn puppies to 0.08 per main female was observed in minks fed HydroLactiV with food, which is 77.78% less compared to the control group [19]. However, in this case, the objective reason for this may be the combined use in HydroLactiVe of organoelement compounds of trace elements together with vitamins and lactobacilli.

5. Conclusions
As shown by our studies, the use of the drug belmin, which includes a complex of biogenic micronutrients, allowed us to reduce the number of stillborn puppies in pregnant female foxes by 44% in a production experiment, which significantly contributed to an increase in the puppies' output to the main female.

Accordingly, taking into account the active participation of organoelement compounds in the metabolism and increasing the productivity of animals, one of the promising areas in feeding fur animals is the inclusion of this group of substances in the premixes.

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