Dynamics of productive qualities of rabbits when creating a new breeding group

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Abstract. Many branches of animal husbandry in our country are in need of domestic highly productive breeds and types of animals. Along with other problems – the lack of domestic developments in the field of animal housing and feeding systems that ensure high production efficiency, the lack of high-quality breeding resources is the most important factor hindering the development of the population's own food production. Technologies and breeding resources of animals borrowed from other countries lead to short-term effects of the development of livestock industries. Rabbit breeding is no exception – the branch of animal husbandry that allows you to get dietary meat at a fast pace. Since the 1940s of the XX century, NIIPZK has been providing scientific support for the formation and development of the rabbit breeding industry. In particular, the scientists of the institute carried out work on breeding. With the participation of the Institute's employees, the Soviet Chinchilla rabbit breed was created and the White Giant breed was significantly improved. To increase the efficiency of rabbit breeding, different two- and three-breed crosses were tested. Since the 1970s of the last century, no work has been carried out to create new crosses of meat-skin and meat breeds of rabbits. The last rabbit breed approved by the Ministry of Agriculture of Russia (2014) was a decorative breed - the Russian dwarf Angora. Currently, rabbit breeding uses breeding resources imported from abroad, which makes the farms dependent and leads to serious financial costs. Therefore, the actual directions in the selection of domestic rabbit breeding are the creation of new domestic highly productive breeds, types, and crosses. The article presents the results of the creation of a breeding group of rabbits to obtain a new breed. The breeding group was created using at the first stage animals of the parental form of the three-breed cross of Spring rabbits, conducting further breeding “in itself” and selecting from the offspring from the best pairs of individuals that meet the target criteria.

1. Introduction
Evaluation of the effectiveness of crossbreeding of different breeds of rabbits among themselves was carried out by scientists of the FGBNU NIIPZK from 1950-1960. XX century [1-4]. Work on the creation of new breeds of rabbits at the Institute has not been carried out for more than 50 years. Currently, the country does not have enough of its own breeding resources to meet the needs of farmers, for this reason, large industrial complexes buy rabbits abroad.

In order to form a gene pool that combines the desired balance between the productive and adaptive potential of animals, the FGBNU NIIPZK developed a method for creating a parent form of a rabbit cross based on two meat-skinned (white giant and Soviet chinchilla) and one meat (California) breed.
according to a complex crossing scheme and obtained three intermediate Genus 1, Genus 2, Genus 3 and the final rabbit cross Rodnik [5]. According to research data, the parental form of the Rodnik cross is not inferior in productive qualities to foreign analogues bred on the rabbit complexes of our country, namely, the fecundity of rabbits is 8.9-8.7 rabbits, the live weight of young animals at 77 days of age is 2.5-2.6 kg, at 90 days of age – 2.9-3.1 kg [5, 6]. The genetic structure of the final Rodnik cross is evaluated, its consolidation, homogeneity and distinctness from the original breeds of rabbits is shown [7], which served as a basis for the basis for continuing research work in the direction of creating a new breed of rabbits.

In order to control the stability of the genetic apparatus in different animal species, the use of the micronucleus test is becoming more widespread, since the variability in the frequency of cytogenetic abnormalities has both genetic and environmental components, and it is closely related to the reproductive function [8, 9].

Despite the obvious advantages of the micronucleus test for assessing the stability of the genetic apparatus, due to its informativeness, accessibility and simplicity, the factors influencing its use still remain insufficiently studied in rabbit breeding.

The aim of the research is to form a new breeding group of rabbits to create a new breed using selection based on target productive qualities and cytogenetic characteristics.

2. Materials and methods
The research was carried out in the department of experimental rabbit breeding of the FGBNU NIIPZK on the population of rabbits of the parent form of the three-breed cross Rodnik, from which a breeding group was formed on the basis of a three-year selection based on the target productive characteristics.

A total of 400 rabbits, 100 males and 2,500 young rabbits were used during the three stages of the research work.

During the experiment, the following indicators were taken into account: female fecundity, the number of rabbits left under the female; the yield of young animals by the age of 45 days to a safely hatched rabbit per okrol; the live weight of young animals at the age of 45-, 60-, 77- and 90-days.

Feeding of rabbits was carried out according to the general economic diet with the use of compound feed PK-90 (generally accepted for the department of experimental rabbit breeding) and hay. Natural mating of experimental animals was used.

At all stages of breeding, descendants were selected that were homogeneous in phenotype – the general color of the hair is white; ears, nose, top of the tail, paws-gray; down-pure white.

For the formation of the initial breeding group of rabbits, the following parameters were determined: fecundity – at least 8.0 rabbits per female; live weight of rabbits during deposition – at least 1.2 kg; live weight of young animals by 77 days of age-at least 2.4 kg; business yield of young animals by 77 days of age on a safely hatched rabbit – at least 7.1 rabbits; groups of males: fertilization-at least 90%; fecundity of rabbits, at least 8 rabbits; live weight of male offspring by 77 days of age – at least 2.4 kg.

To select the desired type of repair young animals at all stages of the work, the exterior was evaluated – the appearance of the animal, due to the constitutional features of the body, and its age-related changes were taken into account. The assessment of rabbits by their appearance was carried out visually (inspection of their appearance), as well as by measuring the main articles of their physique (head, length and shape of ears, chest, back and sacro-lumbar part, abdominal line, croup, development of limbs) and weighing.

The index of the fluidity of adult and young rabbits, which allows to determine the type of rabbit constitution (Method of testing for distinctness, uniformity and stability Rabbits Oryctolagus conicus November 11, 2010. No. 26-12-06 / 42, Federal State Budgetary Institution "Gossortkomissiya"), calculated by the formula: C (stump index) = chest circumference behind the shoulder blades/ body length x 100%.

At the second stage of breeding, the selection of repair young animals of the desired type by productivity was carried out from parents with high reproductive capacity: fecundity of at least 8.0 rabbits per female, the number of reared rabbits per female per okrol by 45 days of age (at least 7.0
rabbits), live weight of young animals at the age of 45 days—at least 1.2 kg; live weight of young animals by 77 days of age— at least 2.4 kg.

At the third stage of selection in the population formed to create a new breed of rabbits, purebred outbred mating among adult rabbits and inbred mating (such as: brother x sister, father x daughter) of rabbits of the repair young was carried out in order to consolidate the desired characteristics.

To assess the stability of the genetic apparatus of rabbits of the created breed, a micronucleus test was used. The micronucleus test was performed by microscopic analysis of blood smears, for the preparation of which a saline solution was used (blood: saline solution-1:1, respectively). The preparations were examined under the microscope Micros Austria pD 2385 at a magnification of 10x1000. Micronuclei were counted in 3000 red blood cells and expressed in ppm (%).

Statistical processing of the obtained data was performed using Microsoft Excel tables included in the standard set of the Windows Microsoft Office application, based on statistical processing methods using the Student's criterion [10].

3. Results and discussion

To form the initial breeding group of the first stage, necessary for the beginning of the creation of a new breed of rabbits, rabbits and males were selected from the parent form of a new three-breeding cross of spring rabbits. The results of measuring the parameters of the exterior of the animals are presented in Table 1.

Table 1. Parameters of the exterior of adult rabbits (8 months and older) for the formation of the initial breeding group.

| Parameters                     | Females (n=127) | Males (n=34) |
|--------------------------------|-----------------|--------------|
| Live weight, kg.               | 5.1±0.05        | 5.0±0.09     |
| Body length, cm.               | 61.5±0.2        | 61.0±0.4     |
| Chest circumference, cm.       | 37.8±0.2        | 37.6±0.3     |
| Body Fatness Index, %          | 61.6±0.3        | 61.7±0.6     |

The data in Table 1 indicate the uniformity of morphometric indicators of adult females and males, which made it possible to form the initial selection group of rabbits. The downness index corresponded to the mesosomal type of the constitution of the evaluated animals.

In the breeding group of the first stage for the creation of a new breed, animals were selected that were homogeneous in phenotype—the general color of the hair is white; ears, nose, top of the tail, paws—gray; down—pure white, the type of constitution—mesosomal.

According to the results of reproduction, the following productive indicators of the breeding group of rabbits of the first stage were established. For adult males: fertilization of rabbits born by them—91.7%; fertility of rabbits—8.5+0.5 rabbits per female; live weight of offspring at 77 days of age-2.5+0.03 kg. For repair males: fecundity of the litter in which he was born—8.0+0.3 rabbits per female; live weight at 77 days of age-2.5+0.07 kg.

The females of the breeding group of rabbits had the following productive indicators. Adult females: fecundity-8.4+0.3 rabbits per female; live weight of offspring at 45 days of age-1.24+0.07 kg; live weight of offspring at 77 days of age-2.30+0.05 kg, 90 days-2.7+0.03 kg; business output of rabbits by 77 days of age-6.8+0.5 heads. Repair females: fecundity of the mother-8.73+0.2 rabbits per female; live weight at 45 days of age-1.1+0.02 kg; in 77 – 2.33+0.03 kg.

The productivity of rabbits, males and young animals of the second stage of breeding was characterized by the following indicators: fecundity-8.6±0.3 rabbits per female; the yield of young animals to jigging-7.2±0.2 heads; live weight at 45 days of age-1.2± 0.03 kg; at 77 days-2.4+0.03 kg, at 90 days-2.8±0.02 kg.

When using the micronucleus test, it was found that the frequency of occurrence of red blood cells with micronuclei varied in males in the range of 0.1-1.3%, on average 0.55±0.07 %; in females—in the range of 0.095-1.6%, on average-0.96±0.05 %. In general, for males and females of the created breed,
this indicator averaged 0.72±0.05%, with fluctuations from 0.095 to 1.6%. The obtained values are within the normal frequency of occurrence of red blood cells with micronuclei for the use of animals in reproduction (no more than 2%), and indicate the stability of the genetic apparatus of rabbits of the breeding group.

As a result of the research work carried out over three years to create a new breed of rabbits, the reproductive qualities of rabbits increased: the fecundity of rabbits increased by 0.4 rabbits per female and averaged 8.8±0.3 rabbits per female, the yield of young animals to be deposited from the mother at the age of 45 days increased by 0.4 heads and amounted to 7.3±0.3 rabbits, the live weight of young animals to be deposited remained at the same level (1.2 kg), but the live weight of young animals to the age of slaughter for meat increased in 77 days and 90 days, respectively, per 100 and 250 g, averaging 2.4±0.02 and 2.95±0.02 kg (the difference in values is statistically significant, p<0.001) (table 2).

### Table 2. Productive qualities of rabbits of the created breed, M±m.

| Stage of work | Fertility, goal. | Exit of young animals to the jigging, goal. | Live weight of young animals in 45 days, kg | Live weight of young animals in 77 days, kg | Live weight of young animals in 90 days, kg |
|---------------|------------------|-------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| I             | 8.4±0.3          | 6.9±0.3                                   | 1.2±0.07                                 | 2.30±0.05                                | 2.7±0.03                                 |
| II            | 8.6±0.3          | 7.2±0.2                                   | 1.2±0.03                                 | 2.4±0.03                                 | 2.8±0.02                                 |
| III           | 8.8±0.3          | 7.3±0.3                                   | 1.2±0.02                                 | 2.4±0.02                                 | 2.9±0.02***                             |

*** - p <0.01.

An increase in the reproductive characteristics of males was noted: the fertilization rate of rabbits born by males increased by 8.3 % and amounted to 100%, the yield of young animals to be deposited from the mother at the age of 45 days increased by 1.3 heads and averaged 7.1±0.4 rabbits, the live weight of young animals at the age of 77 days remained at the same level (2.4±0.02 kg), and increased at 90 days per 100 g, averaging 2.9±0.03 kg (table 3).

### Table 3. Productive qualities of males of the created breed.

| Stage of work | Selectable parameters | Fecundity of females covered by males, M±m | Reared baby rabbits for jigging, M±m | Live weight of male offspring by 77 days of age, kg, M±m | Live weight of male offspring by 90 days of age, kg, M±m |
|---------------|-----------------------|-------------------------------------------|----------------------------------|---------------------------------------------------|---------------------------------------------------|
| I             | 91.7                  | 8.5±0.5                                   | 5.8±0.4                          | 2.4±0.03                                          | 2.8±0.03                                          |
| II            | 100.0                 | 7.9±0.3                                   | 6.7±0.1                          | 2.4±0.4                                          | 2.9±0.2                                           |
| III           | 100.0                 | 8.3±0.4                                   | 7.1±0.4                          | 2.4±0.02                                          | 2.9±0.03                                          |

4. Conclusion

Based on the results of three stages of research work, a selection group of rabbits was formed, consisting of rabbits and males characterized by genome stability, as well as by the results of selection by target productive qualities that meet the requirements of the created breed. 66 females were selected with productivity indicators: fecundity – 8.8±0.3 rabbits per female, young animals were planted at the age of 45 days-7.3±0.3 heads; live weight of young animals at the age of 77 days-2.4±0.02 kg, at the age of 90 days-2.95±0.02 kg; and 11 males with 100% fertilizing capacity of the rabbits they produced and productive indicators: 8.3±0.4 in fecundity and 7.1±0.4 in the number of reared rabbits for jigging; live weight of young animals at the age of 45 days – 1.2±0.02 kg, at 77 days of age-2.4±0.02 kg, at 90 days
of age – 2.9±0.03. Animals of the breeding group are homogeneous in phenotype—the general color of the hair is white; ears, nose, top of the tail, paws – gray; down – pure white.

References
[1] Kushkova G P 1959 Efficiency of industrial rabbit crossing Rabbit breeding and animal husbandry 4 23-7
[2] Kushkova G P and Ryabinina A F 1960 Efficiency of two-breed variable crossing Rabbit breeding and animal husbandry 6
[3] Barsukov V P 1966 Industrial crossing in rabbit breeding: autoref. Dis. ... cand. s-kh. nauk. – (Balashikha) 27
[4] Tinaev N I 1976 The use of crossbreeding for the production of rabbit meat for industrial purposes-based on: autoref. Dis. ... candidate of Agricultural Sciences (Moscow) 26
[5] Shumilina A R 2019 Dynamics of productive indicators of rabbits when creating the final product trekhporodnogo krosa Krolkovodstvo i zverovodstvo 6 9-15
[6] Zhvakina A R, Kharlamov K V, Tinaev N I and Golovanova E V 2017 The creation of a domestic meat hybrid of rabbits Rabbit breeding and animal husbandry 3 22-4
[7] Shchukina E S, Glazko V I, Glazko T T, Kosovsky G Yu and Shumilina A R 2019 Synthetic three-breed rabbit cross and its “novelty” in relation to the original breeds Rabbit breeding and animal husbandry 4 26-33
[8] Kosovsky G Yu 2014 Cell and genomic technologies in improving efficiency animal husbandry Abstract of the dis. doct. biol. nauk (Shchelkovo) 52
[9] Glazko T T, Stolpovsky Yu A and Glazko V I 2010 Genotypic and paratypic factors influencing the results of the micronucleus test Agricultural biology 6 30-4
[10] Sobolev A D 2006 Fundamentals of variation statistics (Moscow: FGOU VPO MSMEIB) 110