EFFICIENCY OF CROSSING RABBITS OF DIFFERENT BREEDS FOR IMPROVING INDICATORS OF MEAT PRODUCTIVITY UNDER CONDITIONS OF INTENSIVE PRODUCTION

Boyko O.V., Havrysh O.M., Luchyn I.S.
Cherkassy research station of bioresources of the NAAS, Cherkassy, Ukraine

e-mail: bioresurs.ck@ukr.net

Abstract: According to the results of the study of indicators of the productivity of rabbits of different breeds when using industrial crossbreeding, which was carried out based on the experimental rabbit farm of the Cherkassy research station of bioresources of the National Academy of Sciences of the Soviet Chinchilla breed of female rabbits and gray males, it was established that under the conditions of intensive rabbit production, the reproductive qualities of Soviet chinchilla female rabbits the combination with males of the gray giant, New Zealand white breeds increases by 10-15%. Also, the use of Soviet chinchilla female rabbits in industrial crossbreeding, and gray giant and New Zealand white males as parental males, allows for increasing the maternal indicators of female rabbits, fattening, and meat productivity indicators of the obtained young rabbits. The best indicators of fattening and meat productivity in young animals were established during interbreeding of rabbits of the studied groups with a probable superiority over animals of pure-bred breeding - fattening indicators: live weight at 90 days of age by 4.0; 3.8% (p<0.05); average daily increases of 4.7-5.4% (p<0.05...0.01); waist width by 5.6-8.7% (p<0.01).

Keywords: female rabbits, crossbreeding, productivity, reproductive capacity, breed, fattening young.

INTRODUCTION

The world trend of selection experience requires constant improvement of existing genotypes and the creation of new ones, better adapted to new technologies of maintenance and breeding. To achieve the set goals, it is necessary to cause the desired changes in heredity and accumulate them over a number of generations using the selected system of technologies of selection, feeding, and maintenance. [1, 2].

The main indicators on which the intensification of rabbit litter production depends are the live weight of rabbits at birth, the safety of nests, the rate of growth and the payment of feed [2, 3].

However, the more signs taken into account during selection, the smaller the effect can be achieved for each of them. Therefore, when starting breeding work in rabbit breeding, one should focus on one or two traits without neglecting others, which should be at least at an average level. In the first stage, attention is paid to maternal qualities: live weight at birth, live weight at weaning (35 days), and safety of rabbits [7, 8].

In order to speed up obtaining the desired productive indicators, it is worth using crossing, which pursues several goals: enriching the heredity of one of the breeds and, on the basis of two or more breeds, creating a new breed (genotype), which would summarize all the positive aspects of the breeds taken for crossing and, according to the main of them, significantly exceeding them [5]. The purpose of such work is to combine different breeds in such a way that the efficiency of production as a whole is maximized [15, 16].
Research on existing genotypes for their combinatorial ability (combinability) can be carried out by direct and reverse (reciprocal) crossing. Based on the results of the crossing, select the best, most highly productive cross-breed offspring, which should be used in further industrial work (hybridization) as parental and maternal forms [13].

To achieve this goal, it is necessary to use breeds that are dominant in traits with high heritability, controlled by genes of additive action, and that show the best combinatorial ability in the form of the heterosis effect. The effect of heterosis should be higher, especially when the breeds are significantly different from each other genetically or are genetically distant [6, 12].

When the selected characteristics are positively correlated with each other, such as birth weight, milk yield, and preservation, selection for these three indicators simultaneously will increase the intensity of the manifestation of fattening characteristics in young rabbits [14].

Obtaining the maximum effect of heterosis is possible when creating genotypes, the offspring of which, when crossed, can be best combined according to the main quantitative indicators. For this, it is necessary to create a maternal form in which the reproductive properties of female rabbits prevail (focus) and two or more parental forms, whose offspring have a predominance of fattening and meat indicators [11]. A successful combination of these genotypes will ensure maximum productivity growth [4].

**MATERIALS AND METHODS**

The research was conducted on the basis of the Cherkassy research station of bio-resources of the NAAS.

Breeds of rabbits bred on the farm: Soviet chinchilla (SCh), gray giant (Gg), New Zealand white (NZW) and offspring from their combination.

In order to improve the meat productivity of the rabbits, the Soviet chinchilla will be used as a maternal chinchilla during the work process. This genotype is most adapted to the production and climatic conditions of central Ukraine (Table 1).

**Table 1. Scheme of combinations of female rabbits of the Soviet chinchilla breed (n=15)**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Genotype</th>
<th>Offspring , F₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>SCh</td>
<td>SCh</td>
</tr>
<tr>
<td>II</td>
<td>SCh</td>
<td>Gg</td>
</tr>
<tr>
<td>III</td>
<td>SCh</td>
<td>NZW</td>
</tr>
</tbody>
</table>

The parental breeds are males of the Gg and NZW; they have more pronounced fattening and meat indicators.

The evaluation of the reproductive capacity of female rabbits will be determined by the index of reproductive quality of female rabbits (IRQR) [9]:

\[
\text{IRQR} = B + 10m + 5z,
\]

where: B - average weight of one rabbit at birth, g;

m - milk yield of female rabbits (live weight of the nest at the age of 20 days), kg;

z - the number of rabbits at weaning at the age of 28 days, goals;

10 i 5 – adjusting coefficients. Evaluation criteria for female rabbits: multifertility, number of stillborn rabbits, high fertility, milk yield, nest indicators at weaning at 28 days of age, IRQR.
For the experiment to determine the fattening and meat indicators of young rabbits obtained from three variants of the combination, by the pair-analog method, 3 groups of young rabbits aged 30 days, 15 goals each, were formed (Table 2).

Using the "complete evaluation indicator" of young rabbits, fattening and meat quality will be assessed. (CEI) [10]:

\[
\text{CEI} = 5,1 \times (K + 2H);
\]

where 5.1; 2 – corrective coefficients;
K – hourly increase (from birth), g;
H – the width of the lower back (in the point adjacent to the knee joints) in centimeters.

Table 2. Scheme of the fattening experiment of young rabbits (n=15)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Genotype</th>
<th>Productive indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>SCh</td>
<td>Live weight of rabbits in 30-90 days, kg</td>
</tr>
<tr>
<td>II</td>
<td>½ SCh ½ Gg</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>½ SCh ½ NZW</td>
<td></td>
</tr>
</tbody>
</table>

The most accurately you can evaluate the young rabbits for CEI in the 3rd. At this age, the rabbit has the most positive correlation between the indicators of the average daily growth and the estimating index.

The technological and economic conclusions are drawn from the use of rabbits of the Soviet chinchilla as a mother breed and males of the gray giant and New Zealand white breeds.

**Research results and their discussion**

It was established that in multiplicity, puppies I group of the pure breed combination Soviet chinchilla (SCh) and II in combination with the males of the gray giant had 11.4 and 11.1 goals, which is 0.7 and 0.4 goals more than in the combination of puppies III group (SCh X NZW) with 10.7 goals (table 3).

It was found that the number of dead-born rabbits with an unbelievable difference was less in rabbit mothers of group II (SCh x Gg) by 0.7 goals. In the I group (SCh), this indicator was 0.87, with a multiplicity of 11.4 goals. The highest number of dead-born rabbits was observed in the III group of rabbit mothers (SCh X NZW) (0.9 goals).

Large fertility was higher in groups where interracial intersection was used: III group: 58 g, II group: 60 g. In the I group of rabbits of pure breed combinations, this indicator was 57 g, which is 1.3g less than in the II and III groups.

Table 3. Reproductive qualities of female rabbits (M±m)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Genotype scheme</th>
<th>Fertility goals.</th>
<th>Including the born of the dead, g goals.</th>
<th>live weight 1 g goals, g</th>
<th>Weight of off-spring, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>SCh</td>
<td>11,4±0,5</td>
<td>0,87±0,19</td>
<td>57±2,5</td>
<td>599±11,31</td>
</tr>
<tr>
<td>II</td>
<td>SCh</td>
<td>11,1±0,5</td>
<td>0,7±0,21</td>
<td>60±2,1</td>
<td>629±13,51*</td>
</tr>
<tr>
<td>III</td>
<td>SCh</td>
<td>10,7±0,49</td>
<td>0,9±0,26</td>
<td>58±2,06</td>
<td>569±13,5</td>
</tr>
</tbody>
</table>

Note: *p<0.05; **p<0.01; ***p<0.001 compared to the 1st group
The weight of the nest at birth is an indicator that combines the three indicators discussed previously. It was greater in female rabbits of the I group (599 g) and in the II group (629 g), which is more than the III group of female rabbits by 30 and 60 g (p<0.05).

One of the important indicators in determining the milkiness of rabbits is the number of bunnies in the nest at the age of 20 days (Table. 4). The combination of the Soviet chinchilla and the grey giant in the group had 9.9 goals, which is 0.5 goals more than in the I and II groups. The percentage of preservation of the nest by groups was best in the III group of rabbits (95.9%), in I (89.3), and in II (95.2%), respectively.

The level of milk production of female rabbits is the second maternal indicator that directly affects the further fattening capacity of young rabbits. It was the maximum in female rabbits of the III and II groups in comparison with I and was 2.73-2.88 kg (p<0.05).

Table 4. Indicators of milkiness in rabbits for 20 days of lactation (M±m)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pair combination scheme</th>
<th>Milkiness females (20 days of lactation )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>♀</td>
<td>♂</td>
</tr>
<tr>
<td>I</td>
<td>SCh</td>
<td>SCh</td>
</tr>
<tr>
<td>II</td>
<td>SCh</td>
<td>Gg</td>
</tr>
<tr>
<td>III</td>
<td>SCh</td>
<td>NZW</td>
</tr>
</tbody>
</table>

Note: *p<0.05; **p<0.01; ***p<0.001 compared to the 1st group

The number of goals of the nest at separation indicates the maternal qualities of the rabbits in the preservation of the progeny and affects the indicator of IRQR (table 5). This indicator in the studies was higher in the rabbits of group II (9.9 goals), which is more by 0.7 goals than in group I and by 0.6 goals in rabbits of group III.

Table 5. Indicators of rabbits in 28 days. (M±m)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pair combination scheme</th>
<th>Indicators of rabbits in 28 days</th>
<th>IRQR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>♀</td>
<td>♂</td>
<td>number of goals</td>
</tr>
<tr>
<td>I</td>
<td>SCh</td>
<td>SCh</td>
<td>9.1±0,27</td>
</tr>
<tr>
<td>II</td>
<td>SCh</td>
<td>Gg</td>
<td>9.9±0,38</td>
</tr>
<tr>
<td>III</td>
<td>SCh</td>
<td>NZW</td>
<td>9.3±0,25</td>
</tr>
</tbody>
</table>

Note: *p<0.05; **p<0.01; ***p<0.001 compared to the 1st group

The single body weight of the rabbit at the decomposition of the nest at the age of 28 days gives an assessment of not only the reproductive indicators of rabbits but also the phenotypic makings the future feeding and meat productivity of young rabbits. According to this indicator, probably the best were puppies of the III group, 570 g (p<0.01). The weight of the nest at separation was probably higher in rabbits of group III (5.29 kg), which is 380 and 869 g more compared to groups I and II (p<0.001).

It was established that the higher rate of preservation of rabbits when excluded at the age of 28 days was observed in rabbit mothers of the II group. The preservation of the nest before separation was greatly influenced by the origin, in rabbits, under intense industrial maintenance, this indicator appeared as a set of productive characteristics of the two breeds.
Given the different levels of indicators of productivity of rabbit mothers, especially those that can directly affect the further development of young rabbits and for the objective assessment of the rabbits themselves, the IRQR index was used. The highest indicator of IRQR was in the rabbits of the II group – 136.8 and III – 133.3 points, the I group at the level of 129.3 points.

Studies have demonstrated that under conditions of intensive production of rabbits, the reproductive qualities of the rabbit breeds of the Soviet chinchilla in combination with the males of the gray giant breeds of the New Zealand white increase by 10–15%.

When conducting the study according to the experimental scheme, the divergence in the age of young rabbits was not more than 2-4 days, in the living weight of one head on average up to 7 grams (Table 6).

**Table 6. Growth intensity for young rabbits, (M±m)**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Average body weight of 1 head, g</th>
<th>Live body weight 1 head age 90 days, g</th>
<th>Average daily gains, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>519±6,64</td>
<td>2723±34,46</td>
<td>36,6±0,5</td>
</tr>
<tr>
<td>II</td>
<td>523±6,54</td>
<td>2837±45,11*</td>
<td>38,4±0,67*</td>
</tr>
<tr>
<td>III</td>
<td>516±6,18</td>
<td>2830±44,4*</td>
<td>38,7±0,7**</td>
</tr>
</tbody>
</table>

Note: *p<0.05; **p<0.01; ***p<0.001 compared to the 1st group

The study established that the young rabbits of the I group, at the age of 90 days, had a living mass of 2723 g, and they were probably dominated by the analogues of the II group by 114 g (p<0.05). Young rabbits of the III group (2830 g) prevailed over the I control group on this indicator by 107 g (p<0.05).

The indicator of average daily growth during the fattening period of 30-90 days had a probable advantage in the young rabbits of group III (p<0.05) compared to the pure-bred offspring of rabbits of group I (p<0.05). The highest average daily increases for the period of 30-90 days were registered in the II and III groups - 38.4; 38.7 g, which is 1.8; 2.1 g higher than peers of the first group (p<0.05).

According to the indicator of waist width, rabbits of the I and III groups probably prevailed relative to the I group (p 0.01) (Table 7).

According to the indicator of carcass weight at the age of 90 days, young rabbits of the II and III groups probably exceeded the I group by 36 g and 86 g (p<0.05...0.01).

Meat production was higher in the young rabbits of the III group, which prevailed over the II group of rabbits by 3.6% and the I group by 4.1%, respectively.

The feed consumption in the studied groups was 3.7–3.85 kg of finished feed per 1 kg of increase. The third group of young rabbits consumed feeding more effectively and predominated the peers of the first group by 150 g and the second group by 50 g.

**Table 7. Fattening and slaughter indicators of young rabbits, (M±m)**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Waist width at the age of 3 months, cm</th>
<th>Weight of the carcass, g</th>
<th>Slaughter output, %</th>
<th>Feed costs per 1 kgnpprocry, kg</th>
<th>CEI , points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>6,29±0,125</td>
<td>1417±15,9</td>
<td>50,92</td>
<td>3,85</td>
<td>49,18</td>
</tr>
<tr>
<td>II</td>
<td>6,66±0,062*</td>
<td>1453±26,2*</td>
<td>51,22</td>
<td>3,75</td>
<td>51,72</td>
</tr>
<tr>
<td>III</td>
<td>6,89±0,09**</td>
<td>1503±28,9**</td>
<td>53,1</td>
<td>3,7</td>
<td>52,48</td>
</tr>
</tbody>
</table>

Note: *p<0.05; **p<0.01; ***p<0.001 compared to the 1st group
The indicator of the comprehensive evaluation (СEI) was the best in the young rabbits of the II and III groups (51.7 and 52.5 points) in relation to the pure breed peers of the I group. The best indicators of feeding and meat productivity were obtained by the young II and III groups due to the characteristics of the combination of the mother genotype of the rabbits of the Soviet chinchilla with the breeds of the gray giant and the New Zealand white, which allowed to concentrate (additive action) genes of high feeding productivity. Thanks to this, the feeding indicators of these groups to rabbits I group: living mass at 90 days of age by 4.0; 3.8% (p<0.05); average daily gains by 4.7; 5.4% (p<0.05…0.01); lumbar width by 5.6; 8.7% (p<0.01).

The advantage of offspring with partial inheritance of the New Zealand white is the better combinative ability with the rabbit mothers of the Soviet chinchilla and the long-term selection of this breed for meat under the conditions of broiler industrial production of rabbits.

CONCLUSIONS

Studies have demonstrated that under conditions of intensive production of rabbits, the reproductive qualities of the rabbit breeds of the Soviet chinchilla in combination with the males of the gray giant breeds and the New Zealand white increase by 10–15%. It was established that the use of the Soviet chinchilla as the mother breed of rabbits and the gray giant and New Zealand white as the father breed of rabbits allows for an increase in the maternal, feeding, and meat indicators of young rabbits. The indicator of average daily gains during the feeding period of 30-90 days was likely to have superiority in young rabbits of group III (p<0,05) over pure rabbit offspring of group I (p<0,05). Maximum daily average gains for the period of 30-90 days were recorded in the II and III groups at 38.4 and 38.7 g, which is 1.8 and 2.1 g higher than peers in the I group (p<0,05). The best indicators of fattening and meat productivity (II and III groups) were obtained by young animals from industrial crossings. The feeding indicators of the II and III groups increased compared to the rabbits of the I group: live weight at 90 days of age by 4.0; 3.8% (p<0.05); average daily increases of 4.7; 5.4% (p<0.05…0.01); waist width by 5.6; 8.7% (p<0.01).

REFERENCES


