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Influence of males of the paternal line with different weight index on the productivity of rabbits of the maternal form of the Hyla Cross

Taras Yakubets*
Postgraduate Student
National University of Life and Environmental Sciences of Ukraine
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine
https://orcid.org/0000-0003-4197-5034

Vasyl Bochkov
PhD of Agricultural Sciences, Associate Professor
National University of Life and Environmental Sciences of Ukraine
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine
https://orcid.org/0000-0002-6204-7571

Abstract. The maternal form of modern rabbit crosses is obtained by crossing ancestral lines. Therefore it is relevant to investigate the effect of using males of the parental line of the Hyla cross with different weight indices on the performance of the main breeding traits of the female rabbits of the parental form of the cross. The purpose of the study was to investigate the level of productivity of rabbits of the maternal form of cross by reproduction signs and to consider the dynamics of the main breeding traits for a number of births. The experiments used 223 rabbits of the maternal form of the Hyla cross, which came from males with different weight indices. To achieve this goal, groups of rabbits were formed, depending on the value of their father's weight Index – Group 1 – ⩽ 100 units, Group 2 – from 100 to 120 units, Group 3 – ⩾ 120 units. The live weight of rabbits after kindling, multiparity, the weight of newborn rabbits, milk yield, and the live weight of rabbits at the time of weaning were determined. Female rabbits that came from males with a high weight index at first kindling significantly outnumbered their peers in multiparity by 1.16-1.23 animal units ($p \leqslant 0.05$), and in milk yield – by 6-6.5%. Rabbits whose parents were males with a high weight index according to the results of the 3rd kindling prevailed over their peers from other males in multiparity ($p \leqslant 0.05$), milk yield ($p \leqslant 0.05$), and also had significantly higher values

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*Corresponding author

of complex indices ($p \leq 0.05$). From the 1st to the 3rd kindling, the multiparity of rabbits increases, on average, by 6.5%. Live weight at birth of rabbits in Groups 2 and 3 had a positive trend and increased by 3.2% and 4.2%, respectively. On average, the milk yield of rabbits increased by 38.6% from the first to the third kindling. The practical significance of the results lies in the fact that to obtain highly productive rabbits of the maternal cross form, it is advisable to use males of the ancestral form with a weight index ⩾ 120 units

Keywords: crossbreeding; live weight; multiparity; fertility; milk yield; breeding

Introduction

One of the main indicators of the sustainability of rabbit breeding is the profitability of farms, the improvement of which is achieved through technical and economic management and improvement of work with the rabbit population (Pascual, & Gómez, 2020; Honchar *et al.*, 2020). Rabbit breeding programmes for the production of rabbit meat provide for crossing rabbits of specially selected lines, in which the parent line mates with the mother form (Juárez *et al.*, 2020). Maternal traits are a key factor in economic efficiency in rabbit breeding. Improving the maternal ability of rabbits is one of the goals of the Hyla D breeding line (Loussouarn *et. al*, 2012).

The main factor in the profitability of rabbit meat production is the number of weaned rabbits per female (Cartuche *et al.*, 2014). Therefore, breeding programmes focused on genetically improving the size of the nest, which led to a significant increase in the overall multiparity of rabbits (García & Argente, 2020; Behiry *et al.*, 2021). The problem of increasing the productivity of rabbits of the maternal form of cross is urgent and requires attention from breeders. However, the literature sources available to us do not sufficiently cover information about the impact of males on the productivity and reproduction of their daughters. Therefore, the purpose of the study is to investigate the influence of males of the paternal line of the maternal form of cross on the indicators of breeding traits of rabbits of the maternal form.

The live weight of a rabbit determines the mass of newborn rabbits. Rabbits with the 1st kindling have lower rates of live weight at birth than females with more litters (Belabbas *et al.*, 2021).

Researchers note that an increase in the total number of rabbits born leads to a decrease in the weight of newborn rabbits and an increase in their mortality in the nest (Szendrö *et al.*, 2019). The reproductive longevity of rabbits is an important feature of the parent lines of rabbits and is determined by the health and high reproductive capacity of females. The safety, growth rate and survival of rabbits during the lactation period determine the size of the nest and the weight of rabbits at the time of weaning (El Nagar *et al.*, 2020).

Live weight at birth is associated with various productive and reproductive characteristics, such as the behaviour of rabbits in the nest, their feeding and milk consumption, growth intensity during fattening, carcass properties and meat quality, and the reproductive ability of replacement rabbits. Newborn rabbits with higher body weight have a higher live weight during the first mating and during the reproductive period than rabbits with a lower live weight (Belabbas *et al.*, 2021).

Lactation and milk yield of rabbits is a crucial factor not only for the safety of rabbits,

but also for achieving appropriate productivity and maturity at the time of weaning. Researchers report a negative correlation between live weight at weaning and post-weaning mortality. There are several factors that affect milk yield at a particular stage of lactation, such as genotype or the length of the period between kindling and subsequent insemination (Arnau-Bonachera *et al.*, 2015).

Thus, the question of the influence of males on the productivity and reproduction indicators of maternal rabbits is relevant. Therefore, the purpose of the study was to investigate the level of productivity of rabbits of the maternal form of cross based on reproduction traits obtained from males with different weight indices and to analyse the dynamics of the main breeding traits for a number of litters.

Materials and Methods

The research was conducted at the premises of LLC "Ferma Krolikoff" in Cherkasy oblast from March 2020 to December 2022. 223 animal units of maternal NG (new generation) cross rabbits were used for the study, which came from males of the paternal line of the maternal form GPS (Grandparents line C) with different weight index (n = 47) and maternal rabbits of the maternal line of the maternal form GPD (Grandparents line D) (n = 79) of the Hyla cross. The weight index was calculated using equation 1:

$$\text{Weight index} = \frac{\text{Live weight, g}}{\text{Straight body length, cm}}. \quad (1)$$

Groups of NG rabbits were formed according to the weight index of their father – Group 1 (n = 64) – weight index ⩽ 100 units, Group 2 (n = 89) – weight index value from 100 to 120 units, Group 3 (n = 70) – ⩾ 120 units. All female rabbits were crossed with males of the parent form Hyla Max, which were analogous in live weight and age.

The rabbits used in the study were kept in rooms with an adjustable microclimate and automatic ventilation. During the study, the room temperature was in the range of 15-22°C, humidity – 60-70%. Rabbits were kept in cages in numbers, depending on their age: rabbits aged 5-10 weeks – 7 animals in a cage, repair young animals aged 10-14 weeks – 3 animals in a cage, aged 14-19 weeks – one animal in a cage. The size of the cages was 0.9×0.425×0.4 m. Rabbits were fed with granulated compound feed, which included wheat bran, sunflower husks, soy cake, and vitamin supplements. Feeding of rabbits was dosed, the animals' access to water was unlimited. Rabbits were first inseminated at 19 weeks of age, and then every 18 days after kindling. The production cycle was 49 days. Controlled feeding of rabbits was used in the first 10 days after kindling.

The live weight of the animals was determined by weighing them on an electronic scale in the morning before feeding. Multiparity was determined by calculating the number of live-born rabbits in the nest. Animal live weight at birth was determined by the average live weight of rabbits after birth. The milk yield of rabbits was calculated using equation 2 proposed by Fortun-Lamothe & Sabater (2003):

$$MY = 1.69 \times DG + 362, \quad (2)$$

where MY – milk yield of rabbits, kg; DG – weight gain of the nest from birth to 21 days, g; 1, 69, 362 – correction factors.

The milk yield coefficient was calculated using equation 3 proposed by Niedzwiadek (1982):

$$M = [(LW^2 - LW^1) : (21 \times LW_2)] \times 100, \quad (3)$$

where LW_1 – nest weight at birth; LW_2 – nest weight at the age of 21 days.

At the age of 3 and 5 weeks, the average live weight of rabbits in the nest was determined. The preservation of rabbits before weaning was determined as the ratio of the number of rabbits at the time of weaning to the number of live newborn rabbits. Weaning of rabbits was carried out at the age of 5 weeks.

For an objective comprehensive assessment of the reproductive capacity of rabbits, a complex indicator of the reproductive qualities of rabbits (CIRQ) was used, which was determined by equation 5 (Kovalenko *et al.*, 2001):

$$CIRQ = 1,1X_1 + 0,3X_2 + 3,3X_3 + 0,35X_4 \quad (5)$$

where X_1 – multiparity, units; X_2 – milk content, kg; X_3 – number of newborn rabbits at 35-day age, units; X_4 – nest weight at the time of weaning, kg, 1.1, 0.3, 3.3, 0.35 – correction factors;

The index of reproductive qualities of rabbits (IRQ) was also calculated by equation (6) (Boiko *et al.*, 2020):

$$IRQ = B + 10\,m + 5Z, \quad (6)$$

where B – average weight of one newborn rabbit, g; *m* – milk content of the rabbit, kg; Z – number of rabbits at weaning at 35 days of age, units; 10,5 – correction factors.

Empirical data were statistically processed using SPSS and Excel software suites using descriptive statistics methods. The mean values of features (M), their errors (m), variance, root-mean-square deviation, and coefficient of variation (Cv) were calculated (Ibatullin *et al.*, 2017).

Results and Discussion

The productivity of rabbits is the basis for the economic efficiency of rabbit breeding. The number and quality of rabbits of the final hybrid, which will be transferred to fattening and sold for slaughter, depends on the multiparity and milk yield of females of the maternal form of the cross. Therefore, the authors studied the level of selection traits of rabbits obtained from males with different weight indices in 3 litters. The productivity of rabbits for the 1st kindling is shown in Table 1.

Table 1. *Significance of the main selection traits in maternal rabbits by the results of the 1st kindling*

Trait	Indicators					
	Group 1 (n = 64)		Group 2 (n = 89)		Group 3 (n = 70)	
	M ± m	Cv,%	M ± m	Cv,%	M ± m	Cv,%
Live weight after kindling, g	4,583.7 ± 75.68	9.56	4,547.4 ± 69.84	8.49	4,684.6 ± 74.30	9.63
Multiparity, animal units	8.54 ± 0.323	34.62	8.61 ± 0.312	33.17	9.77 ± 0.476*	34.85
Live weight at birth, g	62.53 ± 1.161**	13.19	59.34 ± 0.971	11.87	58.29 ± 1.262	15.32
Milk content, g	4,398.0 ± 105.10	26.98	4,439.8±111.46	25.82	4,698.0±133.06	29.99
Milk yield ratio	3.83 ± 0.056	8.72	3.84 ± 0.051	7.85	3.91 ± 0.059	9.17
Weight of a baby rabbit at the age of 3 weeks, g	413.19 ± 11.678	16.72	407.21 ± 9.89	14.60	386.60 ± 11.068	16.94
Weight of a baby rabbit at the age of 5 weeks, g	922.49 ± 12.945	8.13	938.51 ± 8.428	5.89	935.63 ± 10.239	6.56
Preservation of rabbits before weaning, %	88.21 ± 1.470	19.04	88.72 ± 1.172	15.12	89.94 ± 1.521	18.76
CIRQ, points	39.70 ± 1.228	33.20	40.12 ± 1.070	30.45	43.94 ± 1.490*	33.52
IRQ, points	149.86 ± 2.488	9.82	147.68 ± 2.317	8.97	146.19 ± 2.613	10.57

Note: * – $p \leq 0.05$, ** – $p \leq 0.01$ compared to Group 2 rabbits
Source: developed by the author

As can be seen from the Table, Group 3 rabbits had 137.2 g more live weight than Group 2 and 100.9 g more than Group 1, but the difference was not significant. Rabbits obtained from males with a high weight index (Group 3) had the highest multiparity at the 1st kindling – 1.16 units more ($p \leqslant 0.05$) than rabbits of Group 2 and 1.23 units more than rabbits of Group 1. In terms of live weight at birth, the trend was reversed – its highest value was in rabbits of Group 1, while in rabbits of Groups 2 and 3 it was 3.19 g ($p \leqslant 0.01$) and 4.24 g less, respectively. The milk content of Group 3 rabbits was 5.8% higher than that of Group 2 rabbits and 6.8% higher than that of Group 1. According to the milk yield coefficient, which indicates the growth of rabbits during lactation, there was no significant difference between the rabbits of the experimental groups. The live weight of rabbits in the nest, which is an additional criterion for assessing milk yield, was highest in rabbits of Group 1, in Group 2 it was 5.98 g less, and in Group 3 rabbits – 26.59 g less. The live weight of rabbits at weaning in rabbits of different groups did not differ significantly, as well as the safety of rabbits before weaning.

The highest value of the CIRQ index, which determines the reproductive capacity of rabbits in the aggregate, was in females of Group 3, while in rabbits of Group 2 it was 3.82 points less ($p \leqslant 0.05$), and in rabbits of Group 1 – 4.24 points less.

Rabbits of the maternal form are characterised by a high intensity of reproduction, because, according to the technology, insemination of females occurs 17-18 days after kindling. Thus, a valuable biological feature of rabbits is used – the ability to combine pregnancy and lactation. Table 2 shows the productivity of rabbits based on the results of the 2nd kindling.

Table 2. *Significance of the main breeding traits in maternal rabbits based on the results of the 2nd kindling*

Trait	Indicators					
	Group 1 (n = 59)		Group 2 (n = 84)		Group 3 (n = 62)	
	M ± m	Cv,%	M ± m	Cv,%	M ± m	Cv,%
Live weight after kindling, g	4,928.7 ± 72.68	7.63	5,024.5 ± 64.72	6.85	5,274.3 ± 74.97*	7.23
Multiparity, animal units	9.10 ± 0.464	35.49	9.22 ± 0.373	31.94	10.37 ± 0.447*	31.21
Live weight at birth, g	62.51 ± 0.696	6.94	61.24 ± 0.518	5.87	60.73 ± 0.689	6.82
Milk content, g	6,102.7 ± 143.21	23.58	6,158.6 ± 107.36	19.67	6,497.3 ± 131.22*	21.38
Milk yield ratio	4.09 ± 0.010	4.57	4.15 ± 0.015	5.21	4.22 ± 0.016	5.39
Weight of a baby rabbit at the age of 3 weeks, g	418.35 ± 5.513	7.80	414.26 ± 4.231	8.15	416.00 ± 7.740	11.01
Weight of a baby rabbit at the age of 5 weeks, g	942.79 ± 10.219	6.38	940.27 ± 8.438	5.76	941.71 ± 13.715	8.62
Preservation of rabbits before weaning, %	91.34 ± 1.981	16.49	91.57 ± 1.827	15.76	92.58 ± 2.090	17.39
CIRQ, points	43.48 ± 1.569	34.96	45.21 ± 1.146	31.53	48.87 ± 1.465*	30.47
IRQ, points	160.14 ± 6.214	12.96	164.31 ± 4.684	11.39	177.41 ± 4.123*	14.23

Note: * – p≤0.05 compared to Group 2 rabbits

Source: developed by the author

Analysing the data of the results of the 2nd kindling of maternal rabbits, it can be seen that the indicators of reproductive ability have increased compared to the first kindling. Live weight after kindling was the highest in rabbits of Group 3. In terms of multiparity, rabbits that

were obtained from males with a high weight index prevailed over the peers of Groups 1 and 2 by 0.92 and 0.80 units, respectively. After the 2nd kindling, the largest live weight at birth was in rabbits of Group 1. According to this trait, they outnumbered the Group 2 by 1.76 g ($p \leq 0.05$), and Group 3 – by 2.51 g. In Group 3 rabbits, the milk yield index was 435.7 g higher ($p \leq 0.01$) than in Group 2 and 511.6 g higher than in Group 1. According to the milk yield coefficient, rabbits of Group 3, although not significantly, prevailed over their peers of Groups 1 and 2.

The live weight of rabbits aged 3 weeks obtained from rabbits of Group 3 was 1.65 g and 5.87 g higher than that of rabbits descended from rabbits of Groups 2 and 1, respectively. The indicator of the average live weight at the time of weaning in rabbits obtained from rabbits of Group 3 was the highest, it prevailed by the same indicator of rabbits that were obtained from rabbits of Group 2 by 1.5%, and from rabbits of Group 1 – by 2.2%. The preservation of rabbits before weaning in rabbits of all groups was at a high level, but its highest value was recorded in rabbits of Group 3.

According to the indicators of complex indices, rabbits that came from males with a high weight index prevailed over their peers of Groups 2 and 1. Thus, according to the CIRQ index, the difference was 1.11 and 1.46 points.

The productivity of rabbits gradually increases and reaches maximum values at 3-4 kindling. In our studies, there is a certain dynamics of increasing the indicators of reproduction traits from the 1st to the 2nd kindling. The results of the 3rd kindling are presented in Table 3.

Table 3. *Significance of the main breeding traits in maternal rabbits based on the results of the 3rd kindling*

Trait	Indicators					
	Group 1 (n = 59)		Group 2 (n = 84)		Group 3 (n = 62)	
	M ± m	Cv,%	M ± m	Cv,%	M±m	Cv,%
Live weight after kindling, g	4,928.7 ± 72.68	7.63	5,024.5 ± 64.72	6.85	5,274.3 ± 74.97*	7.23
Multiparity, animal units	9.10 ± 0.464	35.49	9.22 ± 0.373	31.94	10.37 ± 0.447*	31.21
Live weight at birth, g	62.51 ± 0.696	6.94	61.24 ± 0.518	5.87	60.73 ± 0.689	6.82
Milk content, g	6,102.7 ± 143.21	23.58	6,158.6 ± 107.36	19.67	6,497.3 ± 131.22*	21.38
Milk yield ratio	4.09 ± 0.010	4.57	4.15 ± 0.015	5.21	4.22 ± 0.016	5.39
Weight of a baby rabbit at the age of 3 weeks, g	418.35 ± 5.513	7.80	414.26 ± 4.231	8.15	416.00 ± 7.740	11.01
Weight of a baby rabbit at the age of 5 weeks, g	942.79 ± 10.219	6.38	940.27 ± 8.438	5.76	941.71 ± 13.715	8.62
Preservation of rabbits before weaning, %	91.34 ± 1.981	16.49	91.57 ± 1.827	15.76	92.58 ± 2.090	17.39
CIRQ, points	43.48 ± 1.569	34.96	45.21 ± 1.146	31.53	48.87 ± 1.465*	30.47
IRQ, points	160.14 ± 6.214	12.96	164.31 ± 4.684	11.39	177.41 ± 4.123*	14.23

Note: * – p≤0.05 compared to Group 2 rabbits
Source: developed by the author

Analysis of the obtained indicators indicates that rabbits that descended from males with a high weight index are characterised by higher indicators of maternal traits. Live weight after the 3rd kindling was 249.8 g higher ($p \leq 0.05$) than in rabbits of Group 2 and 345.6 g higher than in rabbits of Group 1. Rabbits of Group 3 outnumbered their peers of Groups 2 and 1 in multiparity by 1.15 ($p \leq 0.05$) and 1.27 units, respectively. Along with this, rabbits of

Group 1 had the highest live weight at birth, which confirms the inverse correlation between these traits. In terms of milk yield, rabbits of Group 3 had an advantage – it was 338.7 g more ($p \leq 0.05$) than Group 2 and 394.6 g more than Group 1. The milk yield coefficient was also higher in Group 3 rabbits, which indicates a more intensive growth of rabbits in nests from these rabbits.

The average weight of rabbits at the age of 3 weeks in rabbits of the experimental groups was approximately the same, with an insignificant difference between the groups. According to the live weight of rabbits at the time of weaning, there was also no significant difference between the rabbits of the experimental groups. The preservation of rabbits before weaning was highest in rabbits of Group 3. According to this indicator, they outnumbered females of Groups 1 and 2 by more than 1%.

In terms of indices, female rabbits of Group 3 had an advantage over their peers. Thus, according to the CIRQ index, they outnumbered females of Group 2 by 8% ($p \leq 0.05$), and females of Group 1 – by 15.4%. The IRQ index in Group 3 rabbits was 13.1 points higher ($p \leq 0.05$) than in Group 2 and 17.27 points higher than in Group 1.

Analysis of the results of the experiment shows that the main breeding characteristics of rabbits varied from the 1st to the 3rd kindling. The dynamics of indicators of multiparity, live weight at birth, and milk yield can be observed in Figures 1, 2, and 3.

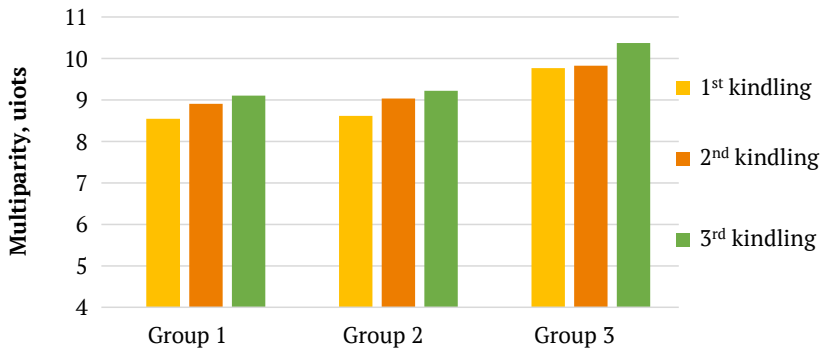

Figure 1. Dynamics of multiparity of female rabbits by kindlings
Source: developed by the author

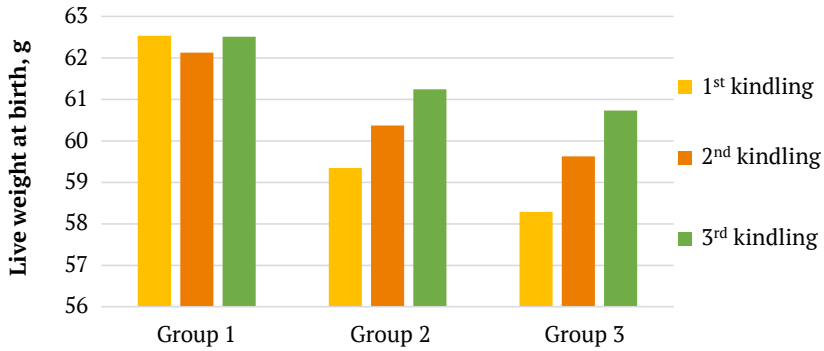

Figure 2. Dynamics of live weight at birth by kindlings
Source: developed by the author

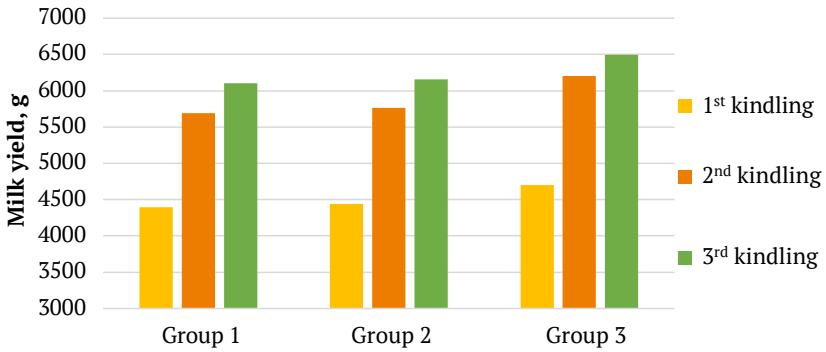

Figure 3. Dynamics of milk yield of maternal rabbits by kindlings
Source: developed by the author

It was found that the multiparity of Group 1 rabbits from the 1st to the 2nd kindling increased by 0.35 animal units or 4.1%, and from the 2nd to the 3rd – by 0.19 units, or 2.1%. In Group 2 rabbits, the increase in multiparity from the 1st to the 2nd kindling was by 0.42 units or 4.9%, and from the 2nd to the 3rd – 0.21 units, or 2.3%. The multiparity of rabbits of Group 3 from the 1st to the 2nd kindling increased by 0.06 animal units, which is 0.6%, and from the 2nd to the 3rd kindling – by 0.54 units or 5.5%.

Live weight of rabbits of Group 1 for the 2nd kindling was 0.4 units less than for the 1st kindling and 0.38 less than for the 3rd kindling. In rabbits of Group , the difference between the 1st and 2nd kindling was 1.03 g in terms of live weight at birth, and between the 2nd and 3rd – 0.87 g. In Group 3 rabbits, the dynamics of live weight at birth was also positive. The growth of this trait from the 1st to the 2nd kindling was 1.33 g, and from the 2nd to the 3rd – 1.11 g.

The milk content of rabbits of all groups increased from the 1st to the 3rd kindling. Thus, in rabbits of Group 1, the increase in milk yield from the 1st to the 2nd kindling was 1,290.9 g, and from the 2nd to the 3rd – 413.8 g. The increase in milk yield in rabbits of Group 2 from the 1st to the 2nd kindling was by 1,325 g, and from the 2nd to the 3rd – by 393.8 g. In females of Group 3, from the 1st to the 2nd kindling increased by 1,502.5 g, and from the 2nd to the 3rd – by 296.8 g.

As indicated by the results of the conducted studies, rabbits of the maternal form of Hyla NG cross are characterised by high productivity. Analysis of these studies suggests that the use of males with different weight indices affects the reproductive capacity of rabbits.

In studies, the multiparity of rabbits obtained from males with a high weight index ranged from 9.77 to 10.37 animal units. Ludwiczak *et al*. (2021) in their studies obtained data on the productivity of rabbits of the maternal form of Hycole cross for a number of kindlings. Researchers point that the multiparity of rabbits increases from 11.2 to 12.1 units from the 1st to the 3rd kindling, and then decreases. High live weight at birth of rabbits of the Hycole cross had a positive trend from the 1st to the 4th kindling, but then decreased. Notably, the live weight at birth of rabbits of Hycole cross was slightly higher than in this study, it ranged from 70.8 to 72.5 g. The researchers also noted an increase in the milk content of rabbits from the 1st to the 3rd kindling, and after the 4th kindling it decreased.

Findings indicate that the size of the nest also affects the live weight of rabbits during weaning. Thus, rabbits from smaller nests have

a higher weight at weaning than rabbits raised in nests with a larger number of rabbits (Fayeye & Ayorinde, 2008). The study by Pałka *et al*. (2018) analysed the growth of young rabbits of the Popelino White and Termon White breeds. The researchers found a significant effect of nest size on the time of birth on the growth of rabbits. The average live weight of newborn rabbits of the Popelino White breed was 64 g due to the smaller size of the nest, and not because of the breed. The live weight of newborn rabbits of the Termon White breed was 72 g.

Ologbose & Bennett (2019) in studies on the productivity and reproduction of rabbits obtained from males of different breeds, found that females obtained from males of the New Zealand White Breed had a higher multiparity, but were inferior to rabbits obtained from males of the Danish breed in terms of live weight at birth. These data describe to a certain extent the influence of males on the productivity of rabbits.

Several similar indicators of the reproductive capacity of rabbits were obtained by researchers (Ludwiczak *et al*., 2020), which examined the milk yield of females and the weight of Hycole rabbits, depending on the number of rabbits in the nest. The researchers found that the average weight of rabbits aged 21 days was higher in nests of 8 rabbits, compared to nests of 10 rabbits. The milk yield coefficient in experimental rabbits ranged from 3.65 to 3.82 and was higher in rabbits with 10 rabbits in the nest. The obtained data on the milk ratio in the current study were slightly higher.

In experiments to study the productivity of rabbits of different genotypes from crossing Hyla rabbits of the New Zealand white breed, researchers found that the multiparity of rabbits that descended from Hyla males was 8.1 units, and crossed rabbits – 8.5 units (Brahmantiyo *et. al*., 2021). These values were lower than those obtained in this study, which may indicate the effectiveness of selecting males with different weight indices for obtaining maternal rabbits.

Results (Savietto *et al*., 2021) of reserchers who investigated the dynamics of changes in the productivity indicators of rabbits for a number of kindlings indicate that the multiparity of rabbits of the burgundy breed, line 1777 and their crossbreeds increased from the 1st to the 3rd kindling from 2.6 to 6.3 animal units in the Burgundy breed, from 6.3 to 10.7 in the line 1777, and from 5.1 to 5.6 in crossbreeds of these genotypes.

In experiments to investigate the influence of the kindling season and its sequence number on the productivity of female rabbits of the cross and local breeds, researchers (Zerrouki *et al*., 2008) obtained data on the likely effect of these factors on the total number of births and multiparity of rabbits, the interval between two kindlings, and preservation during the suckling period. The researchers, as in this study, found a classic pattern of increasing multiparity from the 1st to the 3rd kindling, and in the subsequent litter, there was a tendency to reduce the multiparity of rabbits. High mortality during the suckling period was also found in the 3rd and 4th kindlings (17 and 23% vs. 11-14% for other litters).

According to the data, the milk yield coefficient of rabbits depends on the breed and feed composition. Pałka *et al*. (2017) found that females of the Termon White are characterised by the highest milk yield coefficient – 3.76. The rabbit of the Grey Flemish Giant, on the contrary, had the lowest value of this coefficient (3.18) among the analysed rabbit breeds. Other breeds analysed by these authors showed a similar level of milk productivity (California – 3.63, New Zealand White – 3.72, Popelino White – 3.73). Kowalska & Bielanski (2004) investigated the reproductive capacity of rabbits fed two different compound feeds (5.05% crude fat vs. 3.24% crude fat). Females who received food

with a higher fat content were characterised by a higher milk yield coefficient (4.0 vs. 3.4). In addition, higher milk productivity led to a higher weight of rabbits on the 21st day of lactation (962.6 g vs. 810.6 g).

In experiments with purebred rabbits of the Burgundy breed, the 1777 line, and their cross-breeds (Savietto *et al.*, 2021), the live weight at birth of purebred rabbits from the 1st to the 3rd kindling decreased, and in cross-bred rabbits – remained unchanged.

Similar data on the milk content of rabbits were obtained by Ali *et al.*, (2021); Abd El-latif *et al.*, (2021), who studied the dynamics of milk yield of rabbits of synthetic line V. It was found that the milk content of rabbits increases from the 1st to the 4th kindling, however, less intensively than in the studies conducted by the authors.

Conclusions

The study results indicate the influence of males of the ancestral form with different weight index on the reproductive traits of female rabbits. Female rabbits that came from males with a high weight index outnumbered peers that were obtained from males with a low and medium weight index, in terms of multiparity – by 12.5%, in terms of milk yield – by 5.5%, and in terms of the safety of rabbits before weaning – by 1%. At the same time, the difference in the live weight of rabbits at the time of weaning obtained from rabbits of different groups has not been established. The effect of heterosis on the milk yield of rabbits obtained from males with a high weight index was revealed. By complex rabbit indexes, women who came from males with a high weight index also outnumbered females who came from men with a low and medium weight index. The study of the dynamics of reproductive traits in rabbits over a number of litters showed that in rabbits obtained from males with a high weight index, the growth of multiparity and milk yield is more intense. It was also found that the milk yield of rabbits obtained from males with a high weight index increases intensively from the 1st to the 3rd kindling. Thus, the results suggest that males with different weight indices have a positive effect on the performance of daughters. Based on the research data, it is recommended to use males of the paternal line of the maternal form with a high weight index (⩾ 120 units) to obtain maternal rabbits and use them for crossing with males of the paternal form of the cross. The obtained results indicate that the daughters of males with a weight index of more than 120 units have higher indicators of the main breeding characteristics, in particular, multiparity, milk yield, and preservation of rabbits before weaning, which directly affect the economic efficiency of rabbit breeding.

Further study will be aimed at investigating the genotypic parameters of rabbit selection and determining the strength of the influence of the father's factor on the traits of breeding rabbits of the maternal form of cross.

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Conflict of Interest

None.

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Вплив самців батьківської лінії з різним ваговим індексом на показники продуктивності кролематок материнської форми кросу Hyla

Тарас Васильович Якубець

Аспірант
Національний університет біоресурсів і природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна
https://orcid.org/0000-0003-4197-5034

Василь Миколайович Бочков

Кандидат сільськогосподарських наук, доцент
Національний університет біоресурсів і природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна
https://orcid.org/0000-0002-6204-7571

Анотація. Кролематок материнської форми сучасних кросів кролів отримують внаслідок схрещування прабатьківських лінії. Тому актуальним є дослідження впливу використання самців батьківської лінії материнської форми кросу Hyla з різним ваговим індексом на показники основних селекційних ознак кролематок материнської форми кросу. Метою роботи було дослідити рівень продуктивності кролематок материнської форми кросу за ознаками відтворення та вивчити динаміку основних ознак селекції за ряд окролів. У дослідах використовували 223 кролематки материнської форми кросу Hyla, які походили від самців з різним ваговим індексом. Для досягнення мети було сформовано групи кролематок, залежно від значення вагового індексу їх батька – I група – ⩽ 100 одиниць, II група – від 100 до 120 одиниць, III група – ⩾ 120 одиниць. Визначали живу масу кролематок після окролу, багатоплідність, масу новонароджених кроленят, молочність, живу масу кроленят на час відлучення. Кролематки, які походили від самців з високим ваговим індексом за I окріл вірогідно переважали ровесниць за багатоплідністю на 1,16-1,23 голови ($p \leqslant 0,05$), а за молочністю – на 6-6,5%. Кролематки, батьками яких були самці з високим ваговим індексом за результатами III окролу переважали ровесниць від інших самців за багатоплідністю ($p \leqslant 0,05$), молочністю ($p \leqslant 0,05$), а також мали вірогідно вищі значення комплексних індексів ($p \leqslant 0,05$). Від першого до третього окролу багатоплідність кролематок зростає, у середньому, на 6,5 %. Великоплідність кролематок II і III груп мала позитивну динаміку і зростала на 3,2 % та 4,2 % відповідно. У середньому, молочність кролематок зростала на 38,6 % від першого до третього окролу. Практичне значення результатів полягає у тому, що для отримання високопродуктивних кролематок материнської форми кросу доцільно використовувати самців прабатьківської форми з ваговим індексом ⩾ 120 одиниць

Ключові слова: кросбридинг; жива маса; багатоплідність; великоплідність; молочність; селекція