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THE ANALYSIS OF FEMALE FERTILITY IN NEW ZEALAND WHITE RABBIT AND TERMOND WHITE RABBIT

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Abstract. The objective of the work was to analyse rabbit (*Oryctolagus cuniculus*) reproduction performance as related to rabbit age, month of birth and birth order. The animals were raised on a rabbit breeding farm located in south-eastern Poland. 400 females were subjected to analysis, of which 199 were New Zealand White rabbits and 201 were Termond White rabbits. Variance analysis revealed a statistically highly significant effect of breed and month of birth on the number of young born and raised. Birth order proved to be statistically insignificant. The average number of rabbits born and raised was, respectively, 7.39 and 6.46 for the New Zealand breed and 7.77 and 6.40 for the Termond breed. Coefficients of variation for both the breeds were found to be much higher for the number of rabbits raised than for the number of rabbits born. The highest percentage of litters for the New Zealand breed was associated with females which raised 7 and 8 young and for the Termond breed – 8 and 9 kittens. Rabbit reproduction results on the study farm can be perceived as good.

Key words: number born, number raised rabbits, reproduction, variability

INTRODUCTION

The rabbit (*Oryctolagus cuniculus*) is a farm animal which is utilised in many ways. Rabbits supply valuable and dietetic meat, fur and Angora wool. Moreover, they are used as experimental animals. Additionally, rabbits have recently been

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more and more popular as pets. Rabbit raising is quite an important branch of animal production. Per capita rabbit meat consumption in Poland is low and amounts to 0.4–0.5 kg per year. It is estimated that two-thirds of the yearly meat output, which is 15 th tonnes, are consumed by Poles and one-third is exported [Zając 2005].

Rabbits are animals with enormous reproductive capabilities, producing as many as 70 young per female per year [Zając 2006]. Intense utilisation of does results in them being frequently culled, the culling rate ranging from 80 to 90% [Barabasz and Bieniek 2003].

Reproduction is a complex phenomenon influenced by both genetic and environmental factors [Maciejowski and Jeżewska 1993]. Research has shown that indicators of reproductive performance of female rabbits depend on e.g.: breed, season, female age, nutrition (very important), reproduction methods applied and production technology [Zając 2005, 2006].

The objective of the work is to analyse rabbit (*Oryctolagus cuniculus*) reproduction results of two breeds according to month of birth, and birth order. The analysis was carried out of data obtained from a rabbit breeding farm located in south-eastern Poland.

MATERIAL AND METHODS

New Zealand White and Termond White rabbits were used in the study. They were raised on a breeding farm located in south-eastern Poland. A total of 400 females: 199 New Zealand White and 201 Termond White, were involved. The overall number of litters produced by the females was 1556, including 786 New Zealand and 770 Termond litters. Two litter characteristics were examined, that is number of young born and raised. The females were housed under the same conditions – in cages in an enclosed, environmentally controlled building. The female : male ratio was 5 : 1. The animals received a diet of pelleted feed formulated following the rabbit nutrition standards [Barabasz et al. 1994].

The data obtained were used to calculate the following statistical measures: arithmetic means and coefficients of variation. A three-factor model of variance analysis was used which included the effect of: breed, month of birth and birth order [Ruszczyc 1981]. Reproduction results from a period of 11 months, from December to October, were analysed.

RESULTS AND DISCUSSION

Variance analysis demonstrated a statistically significant influence of breed and month of birth on the number of rabbits born. In the case of the number of rabbits raised, such an effect was found for month of birth only. Birth order was insignificant for both the number born and raised.

Table 1 and 2 present statistical description of number born and raised according to the breed and month of birth. The tables contain arithmetic means ($\bar{x}$) and coefficients of variation (V). The Termond White does had higher mean values of the number born (7.77) compared with New Zealand females (7.39). The reverse was true for the number raised as the respective mean values were 6.46 and 6.40.

Table 1. Statistical characterization of the number of rabbits born according to breed and month of birth (N – number of litters, $\bar{x}$ – mean, V – coefficient of variation)

Tabela 1. Charakterystyka statystyczna liczby urodzonych królików w zależności od rasy i miesiąca wykotu samic (N – liczba miotów, $\bar{x}$ – średnia, V – współczynnik zmienności)

Month of birth Miesiąc wykotu	Breed – Rasa								
	New Zealand White Nowozelandzki biały			Termond White Termondzki biały			Total Łącznie		
	N	$\bar{x}$	V	N	$\bar{x}$	V	N	$\bar{x}$	V
XII	29	7.59^{B}	23.75	21	8.48^{A}	29.98	50	7.96	27.21
I	21	8.00^{A}	31.63	16	7.69^{B}	24.08	37	7.86	28.47
II	65	8.03^{A}	24.81	60	8.72^{A}	33.85	125	8.36	30.06
III	59	8.12^{A}	25.48	45	8.47^{A}	30.06	104	8.27	27.59
IV	72	7.63^{B}	30.90	81	7.62^{B}	28.49	153	7.62	29.58
V	72	6.92^{D}	32.51	90	7.58^{B}	34.49	162	7.28	33.97
VI	92	7.29^{C}	28.50	88	7.49^{B}	29.12	180	7.39	28.77
VII	107	7.14^{D}	27.58	100	7.31^{C}	31.15	207	7.22	29.36
VIII	115	7.05^{D}	29.87	109	7.20^{C}	31.44	224	7.13	30.59
IX	93	7.06^{D}	31.39	121	7.93^{B}	25.11	214	7.56	28.19
X	61	7.69^{B}	28.24	39	8.82^{A}	32.57	100	8.13	30.96
Total – Razem	786	7.39	28.61	770	7.77	30.03	1556	7.58	29.52

A, B, C, D – values followed by capital letters within a breed (column) differ highly significantly ($P \leq 0.01$).
A, B, C, D – wartości oznaczone różnymi dużymi literami w obrębie rasy (kolumny) różnią się wysoce istotnie ($P \leq 0{,}01$).

The results for the number of rabbits born and raised per litter presented herein are similar to the results reported by other authors. Slightly higher values for the New Zealand breed were obtained by Piórkowska et al. [1991, 1992]. Their mean numbers born and weaned were from 7.6 to 7.8 and from 7.1 to 7.3, respectively. The number weaned per female which exceeds 7 is a high value and approaches the numbers obtained on leading foreign farms [Lebas et al. 1986]. Also Niedźwiadek et al. [1995], Zając et al. [1997] and Zając [2005] have reported similar findings.

In his experiment on Termond rabbit, Gacek [1997] obtained the following respective mean values for the number born and weaned: 7.3–7.5 and 6.5. The same breed was studied by Gacek and Barabasz [2004] who recorded a slightly higher mean number born (8.0) but a lower number weaned (5.99). They also noticed that reproduction seasonality in this breed decreased the productive indicators in the autumn months. Moreover, Gacek [1997] pointed out that too large litters are frequently weak and with high mortality of kittens.

Table 2. Statistical characterization of the number of rabbits raised according to breed and month of birth (N – number of litters, $\bar{x}$ – mean, V – coefficient of variation)

Tabela 2. Charakterystyka statystyczna liczby odchowanych królików w zależności od rasy i miesiąca wykotu samic (N – liczba miotów, $\bar{x}$ – średnia, V – współczynnik zmienności)

Month of birth Miesiąc wykotu	Breed – Rasa New Zealand White Nowozelandzki biały			Termond White Termondzki biały			Total Łącznie		
	N	$\bar{x}$	V	N	$\bar{x}$	V	N	$\bar{x}$	V
XII	29	7.17^{B}	36.92	21	8.19^{A}	37.95	50	7.60	37.68
I	21	7.80^{A}	31.63	16	5.69^{E}	75.31	37	7.00	50.61
II	65	7.06^{B}	47.24	60	7.55^{B}	51.59	125	7.30	49.42
III	59	7.44^{A}	42.23	45	7.53^{B}	50.85	104	7.48	45.98
IV	72	6.81^{B}	48.71	81	6.02^{D}	66.64	153	6.39	58.06
V	72	5.79^{C}	55.68	90	6.51^{C}	57.67	162	6.19	57.12
VI	92	6.18^{C}	54.34	88	5.99^{D}	60.20	180	6.09	57.03
VII	107	6.05^{C}	52.58	100	6.01^{D}	54.73	207	6.03	53.50
VIII	115	5.90^{C}	56.71	109	5.43^{E}	66.98	224	5.67	61.57
IX	93	6.18^{C}	52.43	121	6.60^{C}	58.41	214	6.42	56.04
X	61	7.05^{B}	45.26	39	7.28^{B}	62.71	100	7.14	52.75
Total – Razem	786	6.46	47.61	770	6.40	58.46	1556	6.43	52.71

A, B, C, D – values followed by capital letters within a breed (column) differ highly significantly ($P \leq 0.01$).
A, B, C, D – wartości oznaczone różnymi dużymi literami w obrębie rasy (kolumny) różnią się wysoce istotnie ($P \leq 0{,}01$).

Variability was estimated in this work with respect to the number of rabbits born and raised. Coefficients of variation (V) were calculated to reflect the variability in relation to breed and month of birth (Tables 1 and 2). The coefficients for number raised were much higher (on average, 52.71%), than for number born (on average, 29.52%). The Termond breed had higher coefficients of variation for both numbers. According to Niedźwiadek [1983], high variability and improved environmental conditions are necessary for breeding progress in reproductive characteristics to take place. Comparable variability is reported by Zając et al. [1997], whereas Piórkowska et al. [1992] obtained much lower coefficients of variation (12.6–14.3%).

The distribution of the litter sizes for rabbits born and raised according to breed is presented in this paper in the form of a histogram (Fig. 1 and 2). In spite

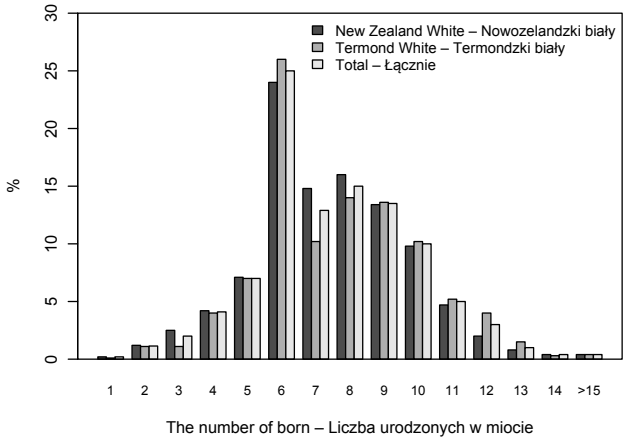

Fig. 1. Histogram of distribution of the number of rabbits born according to breed

Rys. 1. Histogram rozkładu liczby urodzonych królików w zależności od rasy

of a broad range of number born (1–20 young), most litter sizes at birth were within the range of 4–20 young, the number raised ranging between 0 and 15 animals. Litters with 6 newborn rabbits constituted the highest percentage, that is 23.28% and 26.88%, for both the New Zealand White and Termond breed. It is of interest that there was recorded a high percent of litters with 7 and 8 newborn New Zealand White rabbits (respectively 14.76% and 16.41%), and 8 and 9 Termond rabbits. Similar trends were observed relative to the distribution of the number of rabbits raised. The highest was the percentage of New Zealand White litter with 7 and 8 rabbits raised: 14.25% and 15.01%, whereas for Termond females 12.34% and 12.86% litters had 8 and 9 kittens raised. To sum up, the farm examined in the study had does with good reproduction results which can be further improved if the breeding work will be continued.

CONCULUSIONS

The mean number of Termond rabbits born was 7.77 and was higher than the number for New Zealand White (7.39). When the average number of rabbits raised was the case, higher values were recorded for the New Zealand White versus Termond breed (6.46 and 6.40, respectively). Variance analysis demonstrated a statistically highly significant effect of breed and month of birth on number born and raised. Birth order proved to be statistically insignificant for both the numbers. A histo-

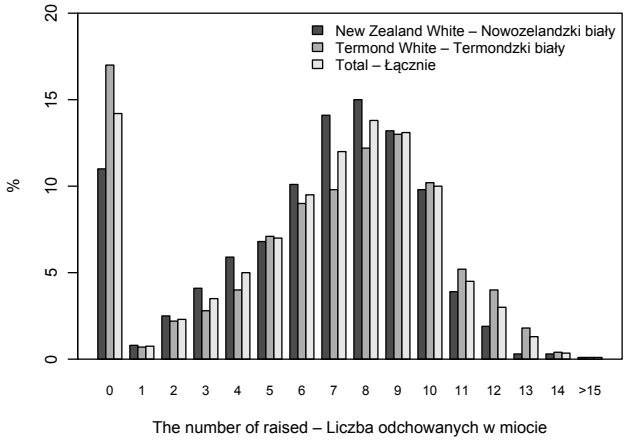

Fig. 2. Histogram of distribution of the number of rabbits raised according to breed

Rys. 2. Histogram rozkładu liczby odchowanych królików w zależności od rasy

gram of the distribution of the litter sizes for rabbits born and raised according to breed showed that litters with 6 newborn rabbits constituted the highest percentage, that is 23.28% and 26.88%, for both the New Zealand White and Termond breed. Similar trends were observed with respect to the distribution of the number of rabbits raised. The highest was the percentage of New Zealand White litter with 7 and 8 rabbits raised: 14.25% and 15.01%, whereas for Termond does 12.34% and 12.86% litters had 8 and 9 rabbits raised. To sum up, the farm examined in the study had female rabbits with good reproduction results which can be further improved if the breeding work will be continued.

REFERENCES

Barabasz B., Bielański P., Jarosz S., Sławoń J, 1994. Normy żywienia mięsożernych i roślinożernych zwierząt futerkowych [Nutrition standards of carnivorous and herbivorous fur animals]. Instytut Fizjologii i Żywienia Zwierząt PAN [in Polish].

Barabasz B., Bieniek J., 2003. Króliki. Towarowa produkcja mięsna [Rabbits. Commodity meat production]. PWRiL Warszawa [in Polish].

Gacek L., 1997. Próba określenia wpływu terminów kojarzeń oraz stosunku poligamii w stadzie na wyniki produkcyjne fermy towarowej królików w Chorzelowie [An attempt to determine the effect of mating times and polygamy ratio in a stock on produc-

tion results of a commodity rabbit farm in Chorzelów]. Rocz. Nauk. Zootech. 24(2), 63–71 [in Polish].

Gacek L., Barabasz B., 2004. Sezonowość w produkcji żywca króliczego [The seasonal character of rabbit livestock production]. Kwart. Króliki 3, 37–41 [in Polish].

Lebas F., Coudert P., Rouvier R., Rochambeau H., 1986. The rabbit: husbandry, health, and production. Roma.

Maciejowski J., Jeżewska G., 1993. Genetyczne uwarunkowania cech rozrodu zwierząt futerkowych [Genetic foundations of fur animal breeding traits]. Zesz. Nauk. Prz. Hod. 12, 5–12 [in Polish].

Niedźwiadek S., 1983. Określenie przydatności do reprodukcji towarowej królików ras średnich w oparciu o metodę kompleksowej oceny użytkowej [Determination of usability for commodity production of intermediate breed rabbits using the method of complex utilization assessment]. Wydanie własne Instytut Zootechniki, Kraków [in Polish].

Niedźwiadek S., Zając J., Bielański P., 1995. Postęp genetyczny w zakresie cech rozpłodowych oraz tucznych i rzeźnych u królików [Genetic progress of reproductive, fattening and slaughter characteristics in rabbits]. Zesz. Nauk. Prz. Hod. 21, 81–90 [in Polish].

Piórkowska M., Niedźwiadek S., Sikora M., 1991. Porównanie dwóch systemów żywienia samic królików w okresie użytkowania rozpłodowego [Comparison of two systems of rabbit female feeding during the period of reproductive utilisation]. Zesz. Nauk. Prz. Hod. 5, 187–192 [in Polish].

Piórkowska M., Niedźwiadek S., Dudziuk W., Sikora M., 1992. Wpływ restrykcyjnego żywienia samic królików na ich użytkowość rozpłodową [The effect of restrictive female rabbit feeding on their reproductive utilisation]. Rocz. Nauk. Zootech. 19(2), 177–187 [in Polish].

Ruszczyc Z., 1981. Metodyka doświadczeń zootechnicznych [The effect of restrictive female rabbit feeding on their reproductive utilisation]. PWRiL Warszawa [in Polish].

Zając J., 2005. Wpływ różnych systemów utrzymania królików na ich wyniki produkcyjne [The effect of different systems of rabbit rearing on their production results]. Kwart. Króliki 2, 29–32 [in Polish].

Zając J., 2006. Rozród pod szczególnym nadzorem [Reproduction under special supervision]. Kwart. Króliki 3, 13–16 [in Polish].

Zając J., Niedźwiadek S., Fijał J., Nogaj J., 1997. Wpływ krotności kryć samic króliczych na ich wskaźniki użytkowości rozpłodowej [The effect of number of matings of female rabbits on indicators of their reproductive utilisation]. Rocz. Nauk. Zootech. 24(3), 97–105 [in Polish].

ANALIZA PLENNOŚCI SAMIC KRÓLIKÓW RASY NOWOZELANDZKI BIAŁY I RASY TERMONDZKI BIAŁY

Streszczenie. Celem pracy była analiza wyników rozrodu królików (*Oryctolagus cuniculus*) w zależności od rasy, miesiąca wykotu oraz kolejności wykotu. Analizą objęto hodowlaną fermę królików znajdującą się w południowo-wschodniej Polsce. Obserwacji poddano 400 samic, z czego 199 stanowiły samice rasy nowozelandzkiej białej i 201 rasy termondzkiej. Od samic uzyskano łącznie 1556 miotów: 786 miotów od nowozelandzkich białych i 770 miotów od termondzkich. Analiza wariancji wykazała statystycznie wysoko istotny wpływ rasy i miesiąca wykotu na liczbę urodzonych i odchowanych króliczą t. Statystycznie nie istotna okazała się kolejność wykotu. Średnia liczba urodzonych i odchowanych królików wynosiła odpowiednio dla rasy nowozelandzkiej białej 7,39 i 6,46 oraz dla rasy termondzkiej 7,77 i 6,40. Stwierdzono, że współczynniki zmienności dla liczby odchowanych królików były znacznie wyższe w porównaniu ze współczynnikami dla liczby urodzonych młodych dla obu ras. U nowozelandzkich białych najwyższy procent miotów pochodził od samic, które odchowały 7 i 8 młodych, natomiast u termondzkich najwyższy procent pochodził od samic odchowujących 8 i 9 sztuk. Wyniki rozrodu królików w analizowanej fermie należy uznać za dobre.

Słowa kluczowe: lczba odchowanych, liczba urodzonych królików, reprodukcja, zmienność

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