

GROWTH AND FEED CONVERSION IN BROILER RABBITS

L. Dědková¹, K. Mach², I. Majzlík²

¹ *Research Institute of Animal Production, Prague-Uhřetěves, Czech Republic*

² *Czech University of Agriculture, Prague, Czech Republic*

In investigations on broiler rabbits HY 2000 and HY PLUS x HY 2000 the body weight, average daily gain, average daily feed consumption and feed conversion have been examined in the period from 46 to 88 days of the age of each rabbit. Compared with the hybrid HY 2000 the hybrid HY PLUS x HY 2000 showed significantly higher daily gain, daily feed consumption and non-significantly better feed consumption during the whole fattening period. The relevant data for the HY PLUS x HY 2000 hybrid were significantly better for the entire fattening period: 38.3 g vs. 33.6 g daily gain 4.53 vs. 4.77 feed conversion. Regarding the higher daily gains the hybrid HY PLUS x HY 2000 reached 2600 g of the market body weight earlier than HY 2000 (81 vs. 88 days old).

rabbit; growth; feed conversion; final hybrid

INTRODUCTION

Up to date, 70 percent of the market production of rabbit meat in the Czech Republic is provided by farm-fattening of broiler rabbits with the commercial names ZIKA, HYLA, GENIA, HY PLUS, HY 2000 etc. A broiler rabbit is generally a four-way hybrid. The reasons for the selection of grand parental populations in the sire and the dam position including subsequent two step crossing (grand parents → parents → final hybrids) are identical with the ones in other multiparous species of livestock (heterosis, position effect, complementarity).

The testing of broiler rabbits has been conducted by the department of Genetics and Animal Production of the Czech University of Agriculture (KGOZ) in Prague since 1992. The testing is centred on growth, feed consumption, feed conversion and carcass quality. It is consequent to similar tests of meat rabbit breed and their crossbreds conducted previously, at KGOZ.

The performance of meat rabbit breeds (purebreds as well as cross-breeds) was analysed by Krogmeier, Dzapo (1991), Mach (1992), Mach, Majzlík (1993), Tůmová, Skřivan (1993), Zajac et al. (1995) and Skřivanová et al. (1997).

Petersen et al. (1988), Tůmová, Skřivan (1993), Mach, Majzlík (1996), Skřivanová et al. (1995, 1996) and Mach et al. (1997a, b) presented the results on the performance of broiler rabbits (growth, feed efficiency and carcass traits of final hybrids).

Findings on growth and the growth curves of meat rabbit breeds as well as broiler rabbits were published in papers by Rudolph et al. (1986), Flach et al. (1988), Blasco, Gómez (1993), Ptak et al. (1993), Mach, Majzlík (1996) and Seeland et al. (1996).

The broiler rabbits originate from the crossing of breeds of medium-sized meat rabbits and showed similar growth characteristics. The fattening usually started at the age of about 30 days and ended during a period from 80 to 100 days. The required body weight lies in the range of 2500 to 3000 g. The reported average daily gain varies between 20 to 40 g. The feed conversion (the feed consumed to the body weight gain) reaches approximately 2.5 to 4.5. Maximal daily gain, mean that the point of inflection of a growth curve, is observed from the 7th to the 10th week of age. The differences in the values of growth traits are caused by the genotype of rabbits but the environmental condition and management show substantial influence on the growth of the fattened rabbits.

The objectives of this study were to compare growth, feed consumption and feed conversion of two final hybrids of broiler rabbit: HY 2000 and a combined hybrid (sire HY PLUS x dam HY 2000) to find whether the combination of gene sources influenced the fattening performance of final hybrids and in what direction.

MATERIAL AND METHODS

The test on final hybrids of broiler rabbits HY 2000 and HY PLUS x HY 2000 was carried out on KGOZ in 1998 in three replications. Hybrid HY PLUS x HY 2000 was the combination of the sire parental line HY PLUS 39 and the dam parental line HY 2000 - P443. Number and age of analysed rabbits are presented in Table I. Where days are used in this paper, they refer to the age of the rabbits.

Rabbits were placed into individual cages and were fed by a commercial pelleted diet containing 16.5% crude protein, 4.5% crude fat, and 15% crude fibre on an *ad libitum* basis throughout the whole fattening period.

I. Number and age of rabbits and the duration of experiment in days

Group / replication	Final hybrid	No.	Start of experiment	Start (days)	End (days)	Length (days)
1 / 1	HY 2000	23	22nd February	46	88	42
2 / 1	HY PLUS x HY 2000	11	22nd February	46	88	42
3 / 2	HY 2000	13	20th April	46	87	41
4 / 2	HY PLUS x HY 2000	12	20th April	46	87	41
7 / 3	HY 2000	10	2nd July	42	84	42
8 / 3	HY PLUS x HY 2000	12	2nd July	42	84	42

The live weight (BW) and individual feed consumption (F) were measured weekly till the end of the experiment. In groups 7 and 8, the data (BW, F) were adjusted by linear extrapolation on the age identical to the other groups. The average daily gain (ADG), average daily feed consumption (ADF) and feed conversion (FC) were calculated from these data for every experimental week as well as for the whole fattening period. For groups 7 and 8, the adjusted data were used in the calculation. For the first week of the experiment, if F were lower than 100 g they were not considered in the analysis.

The analysis was carried out by using the method of ordinary least squares in the procedure GLM of statistical software SAS (SAS Institute, 1988). The linear model included the factors of replication and hybrid. The analysed traits were BW, ADG and ADF for every week of the experiment, for the period from 46 to 81 days and for the whole fattening period from 46 to 88 days. The gender of rabbits was not taken into consideration because of the absence of sexual dimorphism on these traits (Cortier et al., 1969 - cit. Brun, Ouhayoun, 1989; Krogmeier, Dzapo, 1991).

RESULTS

Analysis of variance showed (Tables II and III) that the body weight of rabbits was influenced by replication mainly in an early age while the differences in body weight at 81 and 88 days of age were caused more by the type of hybrid. The significance of the *F*-test for the type of hybrid in the analyses of ADG, ADF and FC corresponds with the significance of a *t*-test that expresses the differences between the hybrids in these traits (Tables IV, V and VI). The replication significantly influenced the ADG and ADF practically during the whole of the fattening period. The value of FC was affected only by the replication from 60 to 81 days (Table II).

II. Significance of *F*-test in the different ages of rabbits

	Age (days)						
	46	53	60	67	74	81	88
Body Weight (g)							
Model	**	*	*	-	-	-	-
Hybrid	-	-	-	-	-	*	*
replication	**	**	*	-	-	-	-
	Age (days)						
	46-53	53-60	60-67	67-74	74-81	81-88	
AGD (g)							
Model		*	*	**	**	**	**
Hybrid	-	*	*	**	*	-	-
Replication	*	-	**	**	**	**	**
ADF (g)							
Model	**	*	**	**	**	**	**
Hybrid	-	*	**	**	*	**	**
Replication	**	-	**	*	*	**	**
FC							
Model	-	-	*	**	**	-	-
Hybrid	-	-	-	-	-	-	-
Replication	-	-	*	**	**	-	-

** $P < 0.01$, * $P < 0.05$

III. Significance of *F*-test for the different age periods

Source / trait	46-81 days			46-88 days		
	ADG (g)	ADF (g)	FC (g)	ADG (g)	ADF (g)	FC (g)
Model	**	*	*	**	**	-
Hybrid	**	**	*	**	**	*
Replication	-	-	-	-	*	-

** $P < 0.01$, * $P < 0.05$

The hybrids HY PLUS x HY 2000 showed during the whole fattening period significantly higher ADG and in the same time higher ADF than HY

IV. The least square means for BW (g), AGD (g), ADF (g), FC (g) of the rabbits

	Age (days)							stderr
	46	53	60	67	74	81	88	
BW (g)								
HY 2000	1249	1530	1798	2034	2275	2486 ⁵	2662 ⁵	21,0-50,0
HY PLUS x HY 2000	1214	1516	1816	2088	2379	2620 ⁵	2823 ⁵	23,3-55,3
	Age (days)							stderr
	46-53	53-60	60-67	67-74	74-81	81-88		
ADG (g)								
HY 2000	40,1	38,3 ⁵	33,6 ⁵	33,6 ¹	34,5 ¹	30,2	1,14-2,59	
HY PLUS x HY 2000	43,1	43,0 ⁵	38,7 ⁵	38,7 ¹	41,6 ¹	34,4	1,26-2,87	
ADF (g)								
HY 2000	117,5	146,8 ⁵	167,1 ¹	166,1 ¹	176,6 ⁵	177,6 ¹	2,99-4,40	
HY PLUS x HY 2000	121,1	158,4 ⁵	183,8 ¹	181,9 ¹	190,8 ⁵	203,2 ¹	3,34-4,87	
FC (g)								
HY 2000	2,98	4,14	5,30	5,06	6,24	13,0	0,13-2,64	
HY PLUS x HY 2000	2,82	4,17	5,22	4,63	5,86	7,82	0,14-2,93	

¹ $P < 0.01$, ⁵ $P < 0.05$ (significance of *t*-test)

stderr - range of standard errors

V. The least square means for AGD (g), ADF (g), FC (g) of rabbits for the whole fattening period

Hybrid	Total gain	ADG	Total F	ADF	FC
	(g)				
HY 2000	1412 ± 40.4 ¹	33.6 ± 0.96 ¹	6729 ± 117.3 ¹	160.2 ± 2.79 ¹	4.77 ± 0.078 ⁵
HY 2000 x HY PLUS	1609 ± 44.7 ¹	38.3 ± 1.06 ¹	7267 ± 131.0 ¹	173.0 ± 3.12 ¹	4.53 ± 0.088 ⁵

¹ $P < 0.01$, ⁵ $P < 0.05$ (significance of *t*-test)

2000 (Table IV). In contrast, the higher BW of HY PLUS x HY 2000 does not occur until 60 days. The differences observed in the BW were of significance as late as in 81 days of age (Table IV).

In both hybrids, maximal ADG was found between 46 to 53 days of age. The hybrids HY PLUS x HY 2000 showed longer period of maximal ADG,

VI. The least square means for AGD (g), ADF (g), FC (g) of rabbits for the period from 46 to 81 days

Hybrid	Total gain	ADG	Total F	ADF	FC
	(g)				
HY 2000	1236 ± 32.7 ¹	35.3 ± 0.93 ¹	5470 ± 92.2 ¹	156.3 ± 2.63 ¹	4.42 ± 0.071 ⁵
HY 2000 x HY PLUS	1405 ± 36.2 ¹	40.2 ± 1.03 ¹	5845 ± 102.6 ¹	167.0 ± 2.94 ¹	4.19 ± 0.080 ⁵

¹ $P < 0.01$, ⁵ $P < 0.05$ (significance of *t*-test)

the decrease of ADG came but after 60 days of age. Between 46 and 53 days of age, we found also the lowest FC. Regarding higher ADG, the hybrids HY PLUS x HY 2000 reached BW 2600 g approximately in 81 days while the hybrids HY 2000 needed one week more. After the age of 81 days, there was a considerable increase of FC in both types of hybrids.

If the period from 46 to 88 days was to be compared (Table V) the significant difference between the hybrids would be found in the ADG and in the ADF, as well as in the FC. The value of the ADG was higher and that of the FC was lower for the HY PLUS x HY 2000.

In contrast to the period from 46 to 88 days of age, in the shorter one from 46 to 81 day of age (Table VI) the rabbits showed higher ADG, lower ADF and therefore even better FC in both hybrids.

DISCUSSION

The body weight gains, daily feed consumption and feed conversion by rabbits corresponded with earlier results published for these hybrids in the Czech Republic. Mach et al. (1997a, b) reported for the broilers HY 2000 in the fattening period from 40 (44) to 82 (86) days of age the AGD 30.5 g to 41.9 g, ADF 105.8 g to 166.3 g and FC 3.2 and 5.2. For the hybrids HY PLUS x HY 2000 they found the AGD 34.8 g to 38.1 g, ADF 145.6 g to 167.1 g and FC 3.9 and 4.8. These findings were obtained during the period 1994 to 1996.

We assume that the higher ADG and the final BW of the hybrid HY PLUS x HY 2000 in comparison with the hybrid HY 2000 were the manifestation of a heterosis caused by the crossing of two different genotypes. The better feed conversion and the shorter time of fattening to the required body weight of 2600 g were caused by the higher weight gains. In rabbits, the positive heterosis for daily gain was found by Brun and Ouhayoun (1989), 2.8% direct heterosis, Krogmeier and Dzapó (1991), 4% heterosis,

Zajac et al. (1995). Mach and Majzlík (1993) reported the 4.3% heterosis for the slaughter body weight at the age of 91 days and Brun and Ouhayoun (1989) the 3.8% for body weight at the age of 79 days.

Comparing the age of maximal daily gains, Mach and Majzlík (1996) reported the earlier age (36 to 42 days) for the hybrids of breeds New Zealand White (NB) and Californian breed (Kal) and the later one (56 and 70 days) for the final hybrids of broiler rabbit ZIKA. Seelands et al. (1996) found the point of inflection between the ages of 55 to 66 days, for medium sized rabbit breeds, Rudolph et al. (1986) for Californian rabbits. Blasco and Gómez (1993) reported maximal growth rate during the age of seven to eight weeks. The rabbits in our experiment were rather characterised by an earlier type of growth corresponding with the results of Mach and Majzlík (1996) that found for the hybrids of NB and Kal. We deduce, following the period of maximal daily gains, that the point of inflection in the examined rabbits laid about the 7th week of their life or earlier. Regarding the high growth intensity of commercial hybrids it is possible that our experiment started after the period of maximal weight gains and the point of inflection occurred at an earlier age.

The moderate increase of ADG after the 74th day seems to be due to the end of undergoing enhanced moulting or it is caused by different nutrient requirements in the various stages of growth (Skřivanová et al., 1997) because only one feed mixture was used during the whole fattening period or it is only due to a slow and fluctuating decrease of maximal daily gains. The fluctuating decrease of daily gains is reported by Rudolph et al. (1986).

Flach et al. (1988) reported for the breed Castor-Rex and its crosses the particularly long period of maximal daily gains (33–34 g) that took from 45 to 70 days of age.

CONCLUSION

It was found that the crossing between two parental lines originating from different groups of breeding product, did not deteriorate the growth and feed efficiency of the final hybrids of broiler rabbits. The broiler rabbits HY PLUS x HY 2000 grew faster, achieved earlier the required final weight (2600 g) and attained better feed conversion than the hybrids HY 2000.

At the same time we found that the differences caused by the type of hybrid were the same or lower than the differences caused by the management and environment, in this case expressed as the effect of the replication. Therefore we conclude that the effectual fattening of broiler rabbits depends in the same proportion on a genotype of rabbits and on the quality of the environment and management.

References

- BLASCO, A. – GÓMEZ, E. A note on growth curves of rabbit lines selected on growth rate or litter size. *Anim. Prod.*, 57, 1993: 332–334.
- BRUN, J. M. – OUHAYOUN, J.: Growth performance and carcass traits in three strains of rabbits and their two-way crosses. *An. Zootech.*, 38, 1989: 171–179.
- FLACH, D. – DZAPO, G. – FIEBRAND, G. – WASSMUTH, R.: Wachstumsvermögen und Wachstumsverlauf von verschiedenen Kaninchenrassen und deren Kreuzungen. *Arch. Geflügelk.*, 52, 1988: 95–103.
- KROGMEIER, D. – DZAPO, V.: Leistung Merkmale von Kaninchen der Rassen Weisse Neuseeländer, Helle Großilber und deren reziproker Kreuzungen 2. Mitteilung: Heterosissteigerungen in Mastleistungs-, Schlachtkörperqualitäts- und Fleischbeschaffenheitsmerkmalen. *Arch. Geflügelk.*, 55, 1991: 162–169.
- MACH, K.: Některé genetické a chovatelské aspekty masné užitkovosti králíků (Some genetic and breeding aspects of meat performance of rabbits). [Thesis for habilitation.] Praha, 1992. – Czech University of Agriculture. 72 p.
- MACH, K. – MAJZLÍK, I.: Uplatnění dialelního křížení při testaci masných plemen králíků (Application of diallel crossing in testing of meat breeds of rabbits). In: *Proc. of XVIth Days of Genetics of Livestock*, Nitra, SR, 6–8 September 1993: 219–223.
- MACH, K. – MAJZLÍK, I.: Průběh růstu vykrmovaných králíků různých genofondů (Growth pattern of fattening rabbits of different gene pools). In: *Proc. of Abstracts of XVIIth Genetic Days*, Brno, 1.–3. 7. 1996. 231 p.
- MACH, K. – MAJZLÍK, I. – ŘÍČAŘ, L.: Testace výkrmnosti a jatečné hodnoty finálních hybridů brojlerového králíka (Testing of fattening and carcass values of final hybrids of broiler rabbits). In: *Proc. of Lectures of the IVth National Seminar New Trends in Breeding of Broiler Rabbits*, CUA Praha, 19. 11. 1997: 46–49.
- MACH, K. – MAJZLÍK, I. – KODEŠ, A. – RAIFOVÁ I.: Rast, spotreba krmiva a jatočná hodnota brojlerových králíkov (Growth, feed consumption and carcass value of rabbit broilers). In: *Proc. Konf. s medzinárodnou účasťou poriadanej pri príležitosti 50. výročia založenia VÚŽV v Nitre*, 8.–9. 10. 1997b: 172–174.
- PETERSEN, J. – FRIENSECKE, G. – LAMMERS, H. J. – GERKEN, M.: Der Einfluß der Besatzdichte und des Geschlechts auf die Mastleistung von Hybridkaninchen. *Arch. Geflügelk.*, 52, 1988: 111–119.
- PTAK, E. – BIENEK, J. – STALINSKI, Z.: Anwendung verschiedener modelle der Wachstumskurven zum Vergleich diverser Kaninchenrassen. In: *8. Arbeitstagung über Haltung und Krankheiten der Kaninchen, Pelztier und Heimtiere*, Celle, 20.–21. 10. 1993.
- RUDOLPH, W. – SOTTO, V. – DUNKER, M. (1986) Wachstum und Schlachtkörperqualität bei Weissen Neuseeländer Kaninchen. *Arch. Tierz.*, 29, 1986: 5–11.
- SAS Institute. SAS–STAT User's Guide, Release 6.03 Edition. Cary, NC: SAS Institute, Inc., 1988. 1028 p.
- SEELAND, G. – RÖSSLER, B. – RÖDER, B. (1996) Analyse des Wachstums verschiedener Kaninchenrassen mit ausgewählten Wachstumsfunctionen. *Arch. Tierz.*, 39: 533–544.
- SKŘIVANOVÁ, V. et al.: Vliv výživy a genotypu na výsledky výkrmu brojlerových králíků (The effect of nutrition and genotype on results of fattening of broiler rabbits). *Náš Chov* (Praha), 1995: 39–40.

SKŘIVANOVÁ, V. – KUBOUŠKOVÁ, M. – MAROUNEK, M.: Srovnání růstu, spotřeby krmiva a úhynu brojlerových králíků (Comparison of growth, feed consumption and mortality of broiler rabbits). *Zemědělec*, IV, 1996: 6.

SKŘIVANOVÁ, V. – MAROUNEK, M. – SKŘIVAN, M. – TŮMOVÁ, E. – LAŠTOVKOVÁ, J.: Vliv krmné směsi na užitkovost, stravitelnost živin a kvalitu masa králíků kombinace novozélandský bílý x kalifornský (The effect of feed mixture on performance, nutrient digestibility and meat quality in New Zealand White x Californian rabbits). *Czech J. Anim. Sci.*, 42, 1997: 459–465.

TŮMOVÁ, E. – SKŘIVAN, M.: Výsledky výkrmového testu králíků (Results of fattening test of rabbits). *Zemědělec*, 43 1993 (1): 6.

ZAJAC, J. – NIEDZWIADK, S. – BIELANSKI, P.: Próba ocacowania efektu heterozji u królików mieszcanców. In: *Biuletyn informacyjny*, Instytut zootechniky Krakov, XXXIII, 1995: 41–53.

Received for publication on September 10, 1999

DĚDKOVÁ, L. – MACH, K. – MAJZLÍK, I. (Výzkumný ústav živočišné výroby, Praha-Uhřetěves; Česká zemědělská univerzita, Praha, Česká republika):

Růstové schopnosti a konverze krmiva u brojlerových králíků.

Scientia Agric. Bohem., 30, 1999: 315–323.

Při testaci brojlerových králíků typu HY 2000 a HY PLUS x HY 2000 byla sledována hmotnost těla, průměrný denní přírůstek, průměrná denní spotřeba krmiva a konverze krmiva, a to pro období od 46. do 88. dne věku králíků. Hybridi HY PLUS x HY 2000 vykázali během celé doby výkrmu statisticky významně vyšší denní přírůstek i denní spotřebu krmiva a lepší konverzi krmiva, i když statisticky nevýznamnou. Rovněž za celou dobu výkrmu měli hybridní HY PLUS x HY 2000 vyšší denní přírůstek (38,3 g vs. 33,6 g) a lepší konverzi krmiva (4,53 vs. 4,77), a to již statisticky významně. Vzhledem k vyšším denním přírůstkům dosáhli hybridní HY PLUS x HY 2000 požadované hmotnosti těla 2 600 g o týden dříve než králíci HY 2000, tj. v 81 dnech věku.

králík; růst; konverze krmiva; finální hybrid

Contact Address:

Ing. Ludmila Dědková, CSc. Výzkumný ústav živočišné výroby, 104 01 Praha 10-Uhřetěves, P.O. BOX 1, Česká republika
