

AN EXPERIMENT ON THREE-BREED-CROSSING OF MIDDLE BREED RABBITS

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Introduction

The increasing consumption of and demand for rabbit meat requires the improvement of its production. One breeding method which makes it possible to quickly improve performance is cross-breeding, which creates heterosis. Cross-breeding of rabbits has been done for many years and to a large extent has been creative is significance. In this way many breeds and various colors have come into being /Herman, 1963/.

The following work, undertaken at the Institute of Zootechnics, involved crossing three middle breeds: White New Zealand, Californian and White Polish.

Material and Methods

The animals included White Polish /BP/, White New Zealand /BN/, Californian /K/, crosses of White New Zealand x Californian /BN x K/ and Californian x White New Zealand /K x BN/. Included were 140 females and 44 males and all the offspring born during one calendar year. The crossings were of the following set-up: 20♀/BN x K/ x ♂BP, 20♀/K x BN/ x ♂BP, 20♀BP x ♂/BN x K/, 20♀BP x ♂/K x BN/.

The control groups were made up of purebred rabbits: 20♀BP x ♂BP, 20♀BN x ♂BN, 20♀K x ♂K.

All animals were reared under identical conditions - metal cages in a heated building. The temperature of the building was 14 - 18°C with a humidity of 68 - 78%.

Adult rabbits were fed the complete granulated mixture "KS". Resting females received 120 g while pregnant and lactating females - 180 - 220 g. Males received a constant amount of 120 g. The young rabbits received the complete granulated mixture "KM" ad libitum.

The young rabbits were weaned at 28 days of age and put into cages of 3 rabbits each of the same sex and from the same parents. They were fattened until 90 days of age after weaning.

The following parameters were observed:

- fertility and mother care,
- litter weight after birth and after 21 days,
- weight of young rabbits at 28, 56 and 90 days of age,
- feed consumption.

Results

The fertility results of females, /Table 1/, show that the largest litters /8.4 rabbits/ were obtained when /BN x K/ females were mated with BP males. When a /K x BN/ female was mated with a BP male 8.3 rabbits per litter were born. When a BP female was bred with a /BN x K/ or /K x BN/ male the number of offspring per litter was reduced to 6.3 - 6.5 rabbits. The number of offspring per litter for purebred female rabbits varied from 6.0 for the BP breed to 7.4 for the Californian breed.

The number of stillborn per litter ranged from 0.2 to 0.5 /3.33 to 7.69%/. The largest number of rabbits weaned per litter was found for /BN x K/ females mated with BP males. The difference in the number of weaned rabbits when /K x BN/ females were bred with BP males was for the remaining groups highly significant and for the Californian breed, significant.

The highest body weight of newborn rabbits occurred with BP x /BN x K/ and /K x BN/ matings and with purebred BP. The lowest body weight /57,6 g/ of newborns was found with purebred K rabbits /Table 2/.

Table 3 gives the body weights of both sexes of rabbits at 28, 56 and 90 days of age. The difference between ^{sexes} was statistically insignifi-

cant. The highest body weight at 28 days of age was found with /BN x K/ x BP matings - 599.2 g. /K x BN/x BP had body weights of 575.6 g which is on the level of purebred BN and K. The lowest body weights were found for purebred BP rabbits - 532.8 g.

At 56 days of age the body weights of /BN x K/x BP crossbreds started to differ significantly in relationship to the other crossings. The difference was statistically highly significant.

At 90 days of age the /BN x K/x BP purebreds had the highest body weights of 2472.5 g. The difference in relation to the body weights of the remaining crossbreds was statistically significant.

The highest body weight gains during the fattening period - 1874 g was found for the /BN x K/x BP crossbreed. The difference with respect to the other crossbreds was statistically highly significant. The body weight gains for the /K x BN/x BP, BP x/K x BN/ and purebred BN and K ranged from 1702.1 to 1742 g /Table 4/.

Feed consumption for 1 kg growth for /K x BN/x BP and /BN x K/x BP was the lowest and was 3.39 and 3.42 kg respectively. Purebred K rabbits consumed 3.46 kg for 1 kg weight gain. Purebred BN rabbits and crossbred BP x/BN x K/ and BP x/K x BN/ consumed 3.51 to 3.53 kg per kg weight gain /Table 5/.

Discussion

White New Zealand and Californian rabbits were considered as exemplary meat breeds commonly used for slaughter material production. These breeds are characterized by good weight gains, low feed consumption and high slaughter and meat indicators /Bednarz and Frindt, 1975; Granat and Zelnik, 1973; Heckman and Mehner, 1970; Niedźwiadek, 1974; Schlolaut, 1977; Surdeau, 1977/. As a third component the White Polish breed was used. These rabbits are disease resistant and have high meat value /Kaszowski and Kawińska, 1959/.

Fertility results showed that mating female /BN x K/ and /K x BN/ with purebred male BP the number of rabbits per litter definitely incre-

ased in relation to the purebred animals. The number of rabbits born and reared per litter for the above mentioned breeds was higher than mating two of the same breeds /Niedźwiadek, 1979; Niedźwiadek and Kawińska, 1982/. The research of other authors also demonstrates that reproduction is improved with crossbreeding /Granat and Zelnik, 1973; Piotrowicz, 1967; Pomytko and Mirošničenko, 1978/.

The body weights of young rabbits differed for individual combinations and should be connected with litter size. Body weight of newborn rabbits showed a definitely negative relationship to the number of rabbits per litter /Kawińska and Niedźwiadek, 1967; Niedźwiadek, 1974; Staliński, 1959/.

The body weights of the rabbits at 28, 56 and 90 days of age show a definite influence of three-breed crossing on the growth rate of the young rabbits. Mating /BN x K/ x BP gave a fast growth rate and daily gains, resulting in a body weight of 2472 g at 90 days of age. The body weights of the crossbreed /BN x K/ x BP at 90 days of age was higher and compared to data found in the literature abroad for two-, three-, or four-breed crossing of other breeds than those crossed in this research /Bombeke et al., 1975; Heckman and Mehner, 1970; Mach and Trojan, 1979; Pomytko and Mirošničenko, 1978; Raimondi and Auxilia, 1973; Rouvier, 1969; Tinaev, 1979/. It is however about 350 g lower than that presented by Surdeau /1977/ for the body weight of the "Hyla" crossbreed. In comparison to research in Poland dealing with two-breed crossing of these same starting components, the body weight of the /BN x K/ x BP crossbreed at 90 days of age is about 300-350 g higher /Bednarz and Frindt, 1975; Niedźwiadek, 1979; Niedźwiadek and Kawińska, 1982/.

The /BN x K/ x BP and /K x BN/ x BP crossbreeds had better feed efficiency for 1 kg growth in relation to the starting breeds. The difference is not great with regard to purebred K and BN, however in comparison to BP it is significant and averages 0.4 kg. Feed consumption for 1 kg growth for both crossbreeds and purebreeds with the exception for

the BP is advantageous for conditions in Poland. It comes within the limits given by other authors /Bombeke et al., 1975; Heckman and Mehner, 1970; Schlolaut, 1977/.

In summarizing the results it can be stated that three-breed crossing of White New Zealand, Californian and White Polish breeds gave definite improvement of traits essential for slaughter material. Female /BN x K/ mated with male BP had the best fertility. Three-breed crossings have high growth rates that results in body weights of about 2.5 kg at 90 days of age with the lowest feed consumption for 1 kg growth.

Bibliography

- Bednarz M., Frindt A. /1975/. Roczn. Nauk Roln., 97, 2, 65-75.
- Bombeke A., Okerman F., Moermans R.J. /1975/. Revue Agric., 2, 421-430.
- Granat J., Zelnik J. /1973/. Živočišna Vyroba., 18, 5, 373-384.
- Heckman F.W., Mehner A. /1970/. Arch. Geflügel. Kleintierk., 19, 6, 301-310.
- Herman W. /1963/. Poradnik hodowcy królików., PWRiL Warszawa.
- Kaszowski S., Kawińska J. /1959/. Roczn. Nauk Roln., T 74-B-2, 331-360.
- Kawińska J., Niedźwiadek S. /1967/. Roczn. Nauk Roln., T 90-B-2, 203-221.
- Mach K., Trojan V. /1979/. Živočišna Vyroba., 24, 9, 705-715.
- Niedźwiadek S. /1979/. Roczn. Nauk. Zoot., 6, 1, 145-153.
- Niedźwiadek S., Kawińska J. /1982/. Roczn. Nauk. Zoot., 9, 1, 99-109.
- Piotrowicz Z. /1967/. Acta Agr. Silv. Ser. Zoot., VII, 2, 100-107.
- Pomytko V.N., Mirošničenko T.K. /1978/. Nauč. Tr. Inst. Puš. Zverovod. Krolikovod., 17, 28-32.
- Raimondi E., Auxilia M.T. /1973/. Ann. Inst. Sper. Zoot., Vol 6, 1, 1-19.
- Schlolaut W. /1977/. Hessische Landesanstalt für Leistungsprüfungen in der Tierzucht. Neu-Ulrichstein.
- Staliński Z. /1959/. Roczn. Nauk Roln., T 74-B-2, 317-328.
- Surdeau P. /1977/. Cuniculture., 4, 2, 68-74.
- Tinaev N.I. /1979/. Nauč. Tr. Inst. Puš. Zverovod. Krolikovod., T 19, 141-

Summary

An Experiment on Three-Breed-Crossing of Middle Breed Rabbits.

The experiment was carried out on 140 females and 44 males of White Polish /BP/, White New Zealand /BN/ and Californian /K/ rabbits and following crosses: BN x K and K x BN, as well as on the offspring born during one calendar year.

The crossings were of the following set-up: ♀/BN x K/ x ♂BP, ♀/Kx BN/ x ♂BP, ♀BP x ♂/BN x K/, ♀BP x ♂/K x BN/. The control groups were made up of BP, BN and K pure bred rabbits.

Three-Breed-Crossing improved slaughter value significantly. BN x K females mated with BP males had higher number of rabbits per litter than remaining combinations.

Three-Breed-Crosses had high growth rate which resulted in receiving 2.5 kg body weight at 90 days of age. Feed efficiency for all combinations was low and ranged from 3.39 kg for /BN x K/ x BP crosses to 3.84 kg for pure bred BP.

Resume

Etudes des croisements entre trois races chez les lapins des races médiocres.

L'objet d'étude étaient 140 femelles et 44 mâles lapins de race: Blanche Polonaise /BP/, Blanche Neo-Zélandaise /BN/, Californienne /K/, croisés reciproques /BN x K/ et /K x BN/ et toute la progéniture, née pendant une année.

On a effectué le suivant programme d'accouplement: /BN x K/ x BP, /K x BN/ x BP, BP x /BN x K/, BP x /K x BN/. Les lapins des races pures BP, BN et K formaient des lots témoins.

Chez les lapins issus de croisement entre trois races on a constaté une réelle augmentation des tous les caractères importants pour la production de chair.

La prolificité des femelles croisées /BN x K/ accouplées avec les mâles de race BP était supérieure en comparaison avec des autres groupes génétiques.

Les lapins issus de croisement entre trois races se caractérisaient d'une plus grande vitesse de croissance, permettant d'atteindre le poids vif de 2,5 kg à l'âge de 90 jours.

Dans tous les groupes des hybrides on a noté un meilleure index de consommation: 3,39 kg chez les croisés /BN x K/ x BP contre 3,84 kg chez la race pure BP.

Table 1

The fertility results of does

Traits	Breed [⊠]	\bar{x}	v%	Differences and their significant						
				/BNxK/xBP	/KxBN/xBP	BPx/BNxK/	BPx/KxBN/	BPxBP	BNxBN	KxK
Number of litter size /alive/	/BNxK/xBP	8,4	26.5		0,1	2.1	1.9	2.4	1.6	1.0
	/KxBN/xBP	8.3	30.6	-		2.0	1.8	2.3	1.5	0.9
	BPx/BNxK/	6.3	40.8	+	+		0.2	0.3	0.5	1.1
	BPx/KxBN/	6.5	34.8	+	+	-		0.5	0.3	0.9
	BPxBP	6.0	39.0	+	+	+	+		0.8	1.4
	BNxBN	6.8	35.0	+	+	+	+	+		0.6
	KxK	7.4	32.0	+	+	+	+	+	+	
	Number of weaning rabbits /alive/	/BNxK/xBP	6.0	34.6		0.5	1.7	1.6	1.7	1.4
/KxBN/xBP	5.5	47.2	+	+		1.2	1.1	1.2	0.9	0.3
BPx/BNxK/	4.3	50.4	+	+			0.1	0.0	0.3	0.9
BPx/KxBN/	4.4	46.9	+	+	-		0.1	0.2	0.8	
BPxBP	4.3	47.9	+	+	-	-		0.3	0.9	
BNxBN	4.6	49.0	+	+	+	-	+		0.6	
KxK	5.2	43.0	+	+	+	+	+	+	+	

[⊠] BN - White New Zealand
 K - Californien
 BP - White Polish

+ P ≤ 0.05
 + + P ≤ 0.01

Table 2

Body weight of New - born /g/

Breed *	\bar{x}	v%	Differences and their significant						
			/BNxK/xBP	/KxBN/xBP	BPx/BNxK/	BPx/KxBN/	BPxBP	BNxBN	KxK
/BN x K/ x BP	61.2	8.3		0.80	3.00	2.40	2.40	0.20	3.60
/K x BN/ x BP	60.4	10.5	-		3.80	3.20	3.20	1.00	2.80
BP x /BN x K/	64.2	15.9	+	+		0.60	0.60	2.80	6.60
BP x /K x BN/	63.6	16.0	+	+	-		0.00	2.20	6.00
BP x BP	63.6	10.4	+	+	-	-		2.20	6.00
BN x BN	61.4	14.0	-	-	+	+	+		3.80
K x K	57.6	14.9	+	+	++	++	++	+	

* Designation - see table 1

+ P ≤ 0.05

++ P ≤ 0.01

Table 3

Average body weight of rabbits /g/

Age /days/	Breed [‡]	Differences and their significance								
		\bar{x}	v%	/BNxK/xBP	/KxBN/xBP	BPx/BNxK/	BPx/KxBN/	BPxBP	BNxBN	KxK
28	/BNxK/xBP	599.2	19.9		23.6	52.0	42.3	66.4	24.1	29.0
	/KxBN/xBP	575.6	19.6	-		28.4	18.7	42.8	0.5	5.4
	BPx/BNxK/	547.2	23.9	++	+		9.7	14.4	27.9	23.0
	BPx/KxBN/	556.9	22.7	+	-	-		24.1	18.2	13.3
	BPxBP	532.8	26.4	++	++	-	-		42.3	37.4
	BNxBN	575.1	25.1	-	-	+	-	+		4.9
	KxK	570.2	20.8	-	-	-	-	+	-	
56	/BNxK/xBP	1486.9	18.6		161.6	216.6	129.8	333.3	144.3	165.7
	/KxBN/xBP	1325.3	20.0	++		55.0	31.8	171.7	16.7	4.1
	BPx/BNxK/	1270.3	20.8	++	+		86.8	116.7	71.7	50.9
	BPx/KxBN/	1357.1	19.1	++	+	+		203.5	15.1	35.9
	BPxBP	1153.6	23.7	++	++	++	-		189.0	167.6
	BNxBN	1342.0	20.0	++	-	+	-	++		20.8
	KxK	1321.2	17.5	++	-	+	+	++	-	
90	/BNxK/xBP	2472.5	13.0		170.8	297.0	173.2	500.9	185.4	200.2
	/KxBN/xBP	2301.7	14.1	++		126.2	2.4	330.1	14.6	29.4
	BPx/BNxK/	2175.5	15.5	++	++		123.8	203.9	111.6	96.8
	BPx/KxBN/	2299.3	14.8	++	-	++		327.7	12.2	27.0
	BPxBP	1971.6	17.8	++	++	++	++		315.5	300.7
	BNxBN	2287.1	15.3	++	-	+	-	++		14.8
	KxK	2272.3	14.9	++	-	+	-	++	-	

[‡] Designation - see table 1

+ P ≤ 0.05

++ P ≤ 0.01

Table 4

Gain in period from 28 to 90 days /g/

Breed \bar{x}	Differences and their significance								
	\bar{x}	v%	/BNxK/xBP	/KxBN/xBP	BPx/BNxK/	BPx/KxBN/	BPxBP	BNxBN	KxK
/BN x K/ x BP	1874.0	15.5		148.6	246.6	131.6	434.7	162.0	171.9
/K x BN/ x BP	1725.4	16.7	+		98.0	17.0	286.1	13.4	23.3
BP x /BN x K/	1627.4	18.6	+	+		115.0	188.1	84.6	74.7
BP x /K x BN/	1742.4	16.7	+	-	+		303.1	30.4	40.3
BP x BP	1439.3	21.3	+	+	+	+		272.7	262.8
BN x BN	1712.0	17.9	+	-	+	-	+		9.9
K x K	1702.1	20.1	+	-	+	-	+	-	

\bar{x} Designation - see table 1

+ P \leq 0.05
 + + P \leq 0.01

Table 5

Daily gains /g/ and feed intake per 1 kg weight gain /kg/

Breed [⌘]	Daily gains /g/	Feed intake per 1 kg weight gain /kg/
/BN x K/ x BP	30.7	3.42
/K x BN/ x BP	28.3	3.39
BP x /BN x K/	26.6	3.51
BP x /K x BN/	28.5	3.53
BP x BP	23.6	3.84
BN x BN	28.1	3.51
K x K	27.9	3.46

[⌘] Designation - see table 1