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SELECTION SCHEME, PERFORMANCE LEVEL AND COMPARATIVE TEST OF TWO LINES OF MEAT RABBITS

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Summary

A description is given of a selection scheme to provide homogeneous and productive meat rabbits for experimental purposes. As a terminal cross, does from the dam line selected for reproductive traits, are combined with males from the sire line, selected for DWG and FCR. Selection criteria during the test period in the dam line (first 3 litters) are initial litter size, weaned kits and milkindex. To increase the prediction of the breeding value, cross fostering of kits is performed to standardize litter size to 8 or 9 kits.

Traits of both lines are given after 2 years of selection. Traits of the test and nucleus does were: 8.51 and 10.67 litter size at birth, 7.91 and 7.98 litter size at weaning, 2651 and 2896g milkindex, respectively. The offspring of the first generation of the sire line had an average DWG of 44.5 g and FCR of 2.91 between 28 and 70d. An increase of DWG of 7 to 9% was obtained in the next 2 generations. However, FCR initially worsened with 4% but improved during the second year (3-6%) due to the use of own tested males. Reproduction problems with this line are mentioned.

In order to evaluate further the selection criteria, a comparative test between both lines was performed with a total of 123 weanlings. Progeny of the dam line was significantly ($P < .05$) heavier at weaning: 642g and 582 g, respectively. The sire line showed a significant ($P < .01$) better DWG (+24%) and FCR (-10%) during the fattening period (28 - 70 days). On the other hand, progeny of the sire line had a 3 - 5% lower dressing percentage ($P < .01$). Slaughter traits are not involved in this selection programme, which illustrates the possibility of negative selection.

Introduction

The importance of a homogeneous strain for experimental purposes has been stressed by Lebas (1986). Furthermore, rabbits are very sensitive to diseases and treatment is difficult, even sometimes impossible (Devrieze et al.,1987). Due to sanitary problems, time consuming and expensive trials can fail. Therefore the main objective of the selection unit at our Research Institute is to provide

homogeneous, healthy and high productive rabbits for the nutrition and reproduction experiments. A secondary objective is to provide genetic stock to breeders. Because of practical and sanitary limitations only a small number of young males or sperm are available.

As well as in other animal productions also for rabbit meat production crossbreeding of specialized breeds or strains is performed, making use of the complementarity between dam lines, having a good reproduction ability and sire lines with excellent meat production characteristics. Based on this principle, our selection unit was reorganized at the end of 1987. Two closed lines were constituted, to provide a terminal cross of does from one line with males of the second line.

In this paper a description is given of the selection scheme adapted to our objectives and taking into account our limited facilities. After 2 years of selection some preliminary traits of the two strains are given.

Material and Methods

1- Animal material:

The initial stock, consisting of New Zealand White, crosses with White of Termonde and Elco hybrids, was used to set up the selection program. Formerly does were selected following the mass principle. Computer data of all relevant production parameters were used to calculate a multiplicative index as a predictor of their breeding value. These data were used to select the initial stock of the two lines.

Does with performances above the population average for litter size and milk production (21d litter weight) were used as nucleus of the dam line. They had at least 4 litters produced. From the end of 1987 they were mated with males descending from "top" does. This initial nucleus of the dam line consisted of 30 does.

The sire line was constituted of female progeny of does with the best progeny results of growth rate and gross feed efficiency in their successive litters. Twenty young does were selected as nucleus and mated with Elco hybrid males which had proven their meat production capacities (Okerman et al., 1987).

2- Housing and reproduction rhythm

The two lines are housed in the same rabbitry, but in different compartments. For the dam line about 100 doe cages are available and 40 wait-gestation cages next to the fattening unit. Does of both lines are mated semi-intensively (10d PP). Thirty doe cages are available for the sire line. Kits are weaned at 4 weeks and 4/litter are transferred to one of the 150 individual cages.

Does af both lines receive a reproduction diet (17.5 % CP; 14.5 % CF; 2500 kcal DE/kg) ad libitum, while fatteners are fed a less concentrated diet (16.5 % CP; 15.5 CF; 2350 kcal DE/kg), in agreement with feeding standards for rabbits (Cheeke, 1987; Lebas, 1989).

3- Selection scheme of the dam line

Only young does descending from the nucleus herd are tested during their first three litters. They are allowed to the nucleus when they obtain at least the following performances during the test period:

* 24 kits born alive (since 1989: 27 kits)
* 22 kits weaned (since 1989: 24 kits)
* an average milkindex of 3.0 kg for litter 2 and 3

Furthermore secondary characteristics are taken into account: 2 times consecutively not pregnant or signs of score hocks are also reasons to eliminate young does.

To increase the prediction of the breeding value during the test period, all litters are standardized to 8 kits at parturition (since 1989: 9) by cross fostering.

Young males, descending from "top" does, are used only on test does. After about one year a selection is done based partially on their progeny and secondary on their live weight (<4.5 kg) and their wire resistance.

4- Selection scheme of the sire line

Individual performance of all progeny is measured between 28 and 70 days, while daily weight gain and feed efficiency only on 4 young/litter. The renewal of the nucleus was initially based on the following selection criteria:

does :	the average of the litter	> population average		
	daily weight gain (DWG)	> 45g	feed conversion (FCR)	< 2.75
males :	daily weight gain	> 50g	feed conversion	< 2.70

Based on the results, criteria for daily weight gain were progressively increased.

5- Comparative fattening test

In order to examine the genetic improvement of both lines a comparative test with weanlings was performed. Eight litters of both lines were housed from weaning (day 28) till slaughter age (day 70) in the same compartment. They were fed the standard fattening diet ad libitum. Each litter was divided over two cages (42 x 60cm). Out of each cage, the rabbit with about the average weight was selected for the slaughtering trial. The fattening trial started with a range of 6 days. Slaughtering was performed at the same day, therefore slaughter age varied between 70 and 76 days. No fasting period was carried out before slaughtering. Standard slaughtering criteria as proposed by Blasco et al. (1990) were used. Traits were subjected to analysis of variance.

Results and Discussion

1- Dam line

In table 1 the average performances of test does and nucleus does of the dam line are given. Data are recorded between September and December 1989, after running two years the selection

scheme. The initial nucleus does were already totally replaced by positive tested young does.

Litter size amounted to 8.51 and 10.67, respectively. This difference can totally been ascribed to the much smaller size of the first litters. It is well known that the traits of primiparous does are lower (Rouvier et al.,1973), but the difference in our strain reached nearly 30% for litter size at birth and about 20% for milk production. Early mating could be the explanation, although their weight was about 80% of adult weight (Table 1).

There were not always enough kits available to standardize litter size to nine. Therefore the allowed number was somewhat lower. On average 7.91 kits were weaned/weaned litter or 93.6% of the allowed number. The milkindex amounted on average nearly 3 kg in the 2nd and 3rd lactation, which was one of the goals of the selection program.

Traits of the nucleus does, composed of positive tested does from their 4th litter off, were 10.67; 7.98; 2.896 kg for respectively litter size at birth, at weaning and milkindex. Litter size of these does was always decreased to 9 kits, while smaller litters were not completed to be sure of the youngs' identity.

Although an exact comparison can not be made, traits of these does were of the same order of the hybrid strains tested at our Institute five years ago (Maertens et al. ,1986). Compared to the former selection stock increased performances were obtained for all selected traits (see Maertens et al., 1986).

2- Sire line

In 1988 most of the offspring belonged to the 1st generation. DWG and FCR amounted to 44.5g and 2.91, respectively (Table 2). An increase in DWG of 7 to 8% was observed in the second generation but FCR was worser (4%). From 1989 on FCR improved till the same level as the first generation.The worsened FCR can be explained by the higher finishing weight, which was about 130 to 170 g higher for the offspring of the second generation. The better FCR from 1989 on can partly be explained by the use of own tested males.

After two 2 years of selection on DWG and FCR in this strain, does showed lower receptivity to the male and especially their ability to live on a wire mesh bottom decreased. These problems could partly be related to the increased adult weight (> 5 kg). A fall of the reproduction and fitness response in DWG selected strains was also observed elsewhere (for a review see Rochambeau de, 1988).

3- Comparative test

Although only a limited number of litters are taken into account for the comparison between both lines, significant to highly significant differences were observed between their traits (Table 3). Kits' weaning weight was 9% higher ($p < 0.05$) in the dam line, although their litter size was higher. This reflects the selection efforts done to obtain increased milkindexes in this line.

However, post-weaning performances were much favourable for progeny of the sire line. In the dam line about the same DWG was obtained as before the selection scheme started. DWG in the sire line was 46.6 g or 24% higher ($p < 0.01$). Also a 10% better FCR was found although their final weight was more than 300 g higher. These results reflect the high heritability of the fattening performances (for a review see Rochambeau de, 1988) and the possibility of quickly increasing performances.

There was no selection performed in both lines on slaughter traits because of staffing limitations. The possibility for negative selection, for this non considered traits, is clearly illustrated in table 3. Although slaughter weight of the progeny of the sire line was higher, dressing percentage was 3-5% lower ($P < .01$) in progeny of the sire line. Because numerous reports have clearly shown a positive relationship between slaughter weight and dressing percentage (Ristic, 1988; Lukefahr et al., 1989; ...), the negative selection effect is even more pronounced. Based on our slaughter traits (Table 3), an explanation for this difference between both lines has to be searched in the visceral part. Probably because of the higher DWG, rabbits of the sire line have a larger intake capacity and a relative higher visceral weight.

References

BLASCO, A., OUHAYOUN, J., MASOERO, G. (1990): Study of rabbit meat and carcass, criteria and terminology. Deuxième conférence sur la production et génétique du lapin dans la région Méditerranéenne. Zagazig, 3-7 September 1990 (Proceedings in press).

CHEEKE, P.R. (1987): Rabbit feeding and nutrition, 376p. Academic Press Inc, Orlando USA.

LEBAS, F. (1986): Comment tester l'efficacité d'un produit devant améliorer les performances d'élevage: Exemple concret. Cuniculture, **13**(1): 16-22.

LEBAS, F. (1989): Besoins nutritionnels des lapins: revue bibliographique et perspectives. Cuni-Sciences, **5**(2): 1-28.

DEVRIEZE, L., MAERTENS, L., OKERMAN, F., and GODARD, C. (1987): Infections dues à un biotype spécialement pathogène de Staphylococcus aureus chez les lapins dans une exploitation d'essai: résultats des traitements et tentatives d'éricution. Rev. de l'Agricult.,**40**: 1275-1282.

LUKEFAHR, S.D., NWOSU, C.V. and RAO, D.R. (1989): Cholesterol level of rabbit meat and trait relationships among growth, carcass and lean yield performances. J. Anim. Sci., **67**: 2009-2017.

MAERTENS, L., OKERMAN, F., DE GROOTE, G. (1986): Evaluation des performances de reproduction et d'engraissement de quelques souches hybrides de lapins. 1. Comparaison des résultats de reproduction. Rev. de l'Agricult.,**39**: 1035-1045.

OKERMAN, F., MAERTENS, L., DE GROOTE, G. (1987): Evaluation des performances de reproduction et d'engraissement de quelques souches hybrides de lapins. 2. Comparaison des résultats d'engraissement. Rev. de l'Agricult.,**40**: 1553-1567.

ROCHAMBEAU DE, H. (1988): Genetics of the rabbit for wool and meat production. Proceed. 4th World Rabbit Congr. Budapest, Vol.2: 1-68.

RISTIC, M. (1988) Einfluss von Geschlecht und Mastenendgewicht auf den Slachtkörperwert von Jungmastkaninchen. 6. Arbeitstagung über Pelztier-, Kaninchen- und Heimtierproduction und -krankheiten. Celle 2 - 4 jun. '88. Ed. Deutsche Vet. Med. Gesellschaft e.V., Giessen, 81-88.

ROUVIER, R., POUJARDIEU, B., VRILLON, J-L. (1973): Analyse statistique des performances d'élevage des lapines. Facteurs du milieu, corrélations, répétabilités. Ann. Génét. Sél. Anim.,**5**: 83-107.

Table 1. Traits of the dam line (period Sept.-Dec. 1989).

	Litter size				Milkindex	Weight of the doe at mating
	alive	allowed kits	at 3 weeks	at weaning	(g)	(g)
Test does						
Litter 1	7,22	8,21	7.68	7.52	2355	3440
Litter 2	9.75	8.71	7.53	8.41	3006	4022
Litter 3	10.17	8.73	8.42	8.31	2974	4218
Mean (n=147)	8.51	8.45	8.03	7.91	2651	3762
± s	2.96	1.33	2.07	2.15	527	466
Nucleus does						
Mean (n=52)	10.67	8.70	8.02	7.98	2896	4293
± s	2.24	.78	1.21	1.21	415	340

Table 2. Performances of progeny of the sire line.

Gene-ration	Year	No of animals	Litter size*	Weight at 28d	Finishing weight at 70d	Daily weight gain (g)	Feed** conversion
1	1988	398	7.80	570 (=100)	2439 (=100)	44.5 (= 100) ± 2.5	2.91 (= 100) ± 0.23
	1989	108	7.71	602 (106)	2479 (102)	44.7 (100) ± 2.0	2.92 (100) ± 0.21
2	1988	113	7.53	580 (102)	2575 (106)	47.5 (107) ± 1.8	3.02 (104) ± 0.21
	1989	329	7.48	634 (111)	2651 (109)	48.0 (108) ± 2.3	2.95 (101) ± 0.20
3	1988	-	-	-	-	-	-
	1989	235	6.71	619 (109)	2656 (109)	48.5 (109) ± 2.8	2.85 (98) ± 0.17

* average litter size at weaning **kg feed/ kg weight gain

Table 3: Comparison of the fattening performances and slaughter yield of both lines.

	Dam line (=100)		Sire line		% [1]
a. Fattening performances					
Number of animals	66		57		-
Weaning weight (28d,g)	642	a[2]	582	b	91
Finishing weight (70d,g)	2221	A	2539	B	114
Daily weight gain (g)	37.6	A	46.6	B	124
Feed conversion	3.18	A	2.86	B	90
b. Slaughter traits					
Number of animals	16		16		-
Liveweight (g)	2358	A	2812	B	119
Dressing percentage (%)					
hot commercial carcass	62,5	A	60,6	B	97
reference carcass	54,1	A	51,4	B	95
net carcass	48,3	A	46,1	B	96
Skin + fore legs (% of live weight)	14,3	a	14,3	a	100
Liver (% of live weight)	3,4	A	4,3	B	126
Perirenal and scapular fat (% of l.w.)	1,6	a	1,9	a	119

[1] Sire line as % of the dam line
[2] A,B: $p<.01$ a,b: $p<.05$