Proceedings 4th World Rabbit Congress, 10-14 October 1988, Budapest Hungary, Vol. 2, 197-208

Influence of final fattening weight on the carcase value and meat quality of young fattening rabbits

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1. Introduction

The production of rabbit meat is gaining more and more importance. For that there are several fattening hybrids available. There is the opinion that the young fattening rabbits should be slaughtered at a live weight of 2,2-2,5 kg, that weight can be reached by intensive feeding after 75-80 days of age (MÖSCH et al., 1984; PETERSEN et al., 1988; RUDOLPH et al., 1986). Aim of this investigation was to determine how far the influences of the different final fattening weight is influencing the carcase value and the meat quality of young fattening rabbits.

2. Material and methods

Included in the investigation were 72 rabbit carcases of different final fattening weight. Available were the breed White New Zealand (WN) and the crossbreedings of both sexes of German Giants (GG) x (RussianxWN) GG x (RussianxWN). After reaching the weight of 2,6, 2,8 and 3,0 kg at the WN and 2,8, 3,0 and 3,2 of the GG x (RussianxWN) the animals were slaughtered. The fattening period started at the age of 28 days and lasted, depending of the weight class, till the 59-62 respectively 59-65 days. During that fattening time data were recorded of the fattening yield (n = 220). After slaughtering and chilling the carcases were packed, frozen at -30°C and stored at -24°C for 8 weeks until investigation took place. Thawing took place for approximately 24 hours at +4°C. The carcases were then dissected and musculature of the back and leg examined as follows:

Table:

Traits	Number of measurements	Procedure resp. measuring device
slaughter weight	1	weighting
cut and carcase tissue dissection	2	percentage to the slaughter weight resp. to the cut
pH-value	2	Digital pH-meter Portamess 651
color	3	Göfo-Meter
meat color	2	1=very light, 100=very dark
water binding capacity	1	Hunterlab, GRAU/HAMM-method(1957)
water content	2	sandbowl-method (+105°C, 5 hours)
ash "	2	ashed in Muffelstove (+600°C)
fat "	2	Soxhlet
protein "	2	Kjeldahl
sensory	6	sen-num.intervall scale 6-1
grill loss	1	weight difference, plate grill 6 min. at appr.+220°C
objective tenderness	2	Warner-Bratzler (2000)

The test material was orthogonally prepared; the evaluation took place by means of a two-factorial analysis of variance for each breed separately, whereby the significance was examined with the F-test.

3. Results and discussion

Significant differences existed between the weight classes of both origins (tab. 1, 2). The differences in the daily gain and in the daily feed consumption led to significant differences in the feed efficiency. However, there were no differences between the weight classes in the daily gain at GG x (RussianxWN). The differences in the feed efficiency were also not significant between the weight classes 2 and 3 of both origins. There was the tendency that at higher final fattening weight the feed consumption increased and the feed efficiency was bad. The results of the slaughter yield show that the selected differences in the final fattening weight led to different ready for slaughter. The slaughter yield improved by an increase of the final fattening weights. The

differences were significant concerning the slaughter yield (cold). The average slaughter yield was 57 %, WN revealed 0,5 % higher slaughter yield than GG x (RussianxWN). The pelt proportion reached in average 15,8 %. The differences were insignificant between the origins. The kidney fat increased partly significantly with increasing final fattening weight.

6 carcases were taken for investigation of slaughter and meat quality of each weight and sex group out of the total material. The WN reached in average a slaughter weight of 1492 g, GG x (Russian x WN) 1632 g (tab. 3). The influences of the sex and of the final fattening weight were significant at the WN; here the male animals were in average 42 g heavier. At the GG x (RussianxWN) the differences in the final fattening weight were only statistically significant. The proportion of the leg decreased significantly at the WN with increasing final fattening weight. The back cut was not influenced by the examined factors of variance (x=23,2 %). In tendency significant seems only that the proportion of the fore leg decreases with increasing final fattening weight. There is no uniform tendency for the belly and fore leg neither at the factor of influence of the final fattening weight nor for the sex; the belly proportion increased at the female animal of the crosses GG x (Russian x WN) with increasing final fattening weight. Differences existed in the fore leg at the origin WN between both sexes and the 3 final fattening weights. Thus the proportion of the fore leg was higher at the male than at the female animals and increased significantly with an increase of the final fattening weight. In the cross-bred GG x (RussianxWN) the influence of the weight was statistically not significant. The edtible offals (kidney, heart and liver) reached a proportion of 6,8 %. This proportion was at the WN of about 0,4 % above that of the GG x (Russian x WN). There were no distinct differences in the meat/bone ratio between the breeds. However, it was in favor of the GG x (Russian x WN) with increasing final fattening weight.

The meat proportion of the primal cuts leg and back reached a percentage of 73,8 and 75,70resp. 67,9 and 70,6 (tab.4). The male animals of both origins had a higher meat proportion in the leg.

The meat proportion of the back decreased with increasing final fattening weight at WN. The bone proportion decreased with increasing final fattening weight at the GG x (RussianxWN). Contrary increased the fat proportion of the leg and also of the back. In this cross-breed the carcases of the male had a higher bone and fat proportion but also a lower fat proportion in the leg. However, there were no sex differences concerning the back.

The pH values of the back and leg musculature showed a different level ($\bar{x}$ 5,46 to 5,74) (tab. 5). The influence of the final fattening weight was found in both cuts, however without distinct tendency between the individual weight levels. The color of the back muscles was getting more intensive with increasing final fattening weight at the breed WN. In opposition the intensity of the color in the leg muscle fainted with increasing final fattening weight of the cross-breed GG x (Russian x WN). The yellow color tone (+b) was partly influenced by the examined cause of variance as well in the back as in the leg muscles. Concerning the filter press method of water binding (cm^2) of the leg muscluature the female animals of the breed WN were in favor. GG x (Russian x WN) showed in tendency an improved water binding capacity with increasing final fattening weight. The liquid pressed area was in average at 7,9 cm^2.

The grill loss in percent of the leg musculature remained an influenced at approximately 24,0 %. The objective tenderness, measured with the Warner-Bratzler device showed that the tenderness was negatively influenced at the breed WN and positively at the cross-breed GG x (Russian x WN) by the different final fattening weight. The male rabbits of the cross-breed GG x (Russian x WN) were better scored than the female rabbits in respect of the tenderness.

The water and ash content of the leg muscles showed the un-influences of the sexes and of the final fattening weights (tab 6). The water content increased at higher final fattening weight. The fat content remained uninfluenced ($\bar{x}$ = 1,35 %). The protein

content was influenced by the final fattening weight with a small decrease.

The sensory scores were more influenced by the final fattening weight than by the sex. These influence was marked distinctly at the cross-breed GG x (Russian x WN). The sensory scores improved with increasing final fattening weight.

According to SOTTO (1983) the meat proportion increased during the growth from 35,7 to 59,9 % (84 days) and decreased then up to 57,7 % at the 147th day due to the increasing fat proportion. According to RISTIĆ (1986) was the same meat amount of in average 59, 8 % determined at an age of 10 to 14 weeks. Kidney and fat layer increased distinctly after the 14th week of age. The meat proportion of the leg and back reached at ready for slaughter rabbits about 74 % of the total meat amount. The samples were better scored by the panelists with increased age of the carcases. According to PETERSEN (1988) the bone proportion of the leg decreased with increasing live weight, however, the meat proportion increased, this can not be confirmed in the present investigation. The higher final fattening weights of the cross-breed GG x (Russian x WN) revealed better data of the carcases than at the breed WN.

4. Literature

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5. Summary

Investigated was the influence of the final fattening weight of rabbits of the origin White New Zealand (WN) (2.6, 2.8, 3.0 kg) and a crossing of German Giants (DR) (Russian x White New Zealand) (2.8, 3.0, 3.2 kg) of both sexes on the carcass value and meat quality. After a storage of approximately 8 weeks at -24°C, the rabbits were thawed for 24 hours at +4°C, disected and the following parameters of the back and leg musculature measured: physical traits (pH value, lightness, meat color and water binding capacity), chemical composition (water, ash, fat protein), sensory, objective ten-derness (Warner-Bratzler-Device) as well as the carcase data and the tissue proportions.

Slaughter yield reached 57 %. The proportion of the leg increased at DR x (Russian x WN) with increasing final fattening weight and decreased at WN. The meat/bone ratio improved with increasing final fattening weight at DR x (Russian x WN). By increasing of the final fattening weight at DR x (Russian x WN) decreased the bone proportion of the leg and of the back. The meat proportion remained unchanged. An influence of the final fattening weight was sporadically found at the physical traits. The heavy rabbits of the crossing DR x (Russian x WN) were in favor concerning the objective tenderness. The water content of the leg musculature increased and therefore decreasing the protein content. The sensory scores improved by increasing final fattening weight.

Table 1: Mean values of the fattening and slaughter yield - White New Zealand

Weight class						male			female		
		1	2	3	F-values	1	2	3	1	2	3
Number of animals	n	50	30	30		25	15	15	25	15	15
Age at begin.of fattening	days	28	28	28		28	28	28	28	28	28
Weight " " "	g	503	518	509	1,41	501	528	508	508	507	512
Weight at end of fattening	g	2683a*)	2833b	3012c	376,66**	2668	2821	3007	2698	2845	3017
Fattening period	days	58,6	59,4	61,9	1,73	58,6	60,3	62,3	58,6	58,5	59,6
Daily gain	g	37,5a	38,7a	40,6b	9,19**	37,4	37,6	39,8	37,6	39,7	41,4
Daily feed consumption	g	124,5a	139,2b	142,5b	41,22**	124,7	139,5	142,5	124,2	138,8	142,5
Food efficiency	kg	3,34a	3,51b	3,52b	7,54**	3,37	3,52	3,58	3,32	3,50	3,49
Slaughter yield, hot	%	57,6	58,0	58,6	1,88	58,6	58,5	59,6	56,8	57,5	57,5
Slaughter yield, cold	%	55,6a	56,5b	57,1b	6,10**	56,3	57,1	58,2	54,8	55,9	56,0
Pelt proportion	%	15,4a	15,7a	16,4b	10,38**	15,5	15,5	16,6	15,3	15,9	16,1
Head proportion	%	7,5a	7,3ab	7,2b	3,39*	7,6	7,3	7,5	7,4	7,3	7,0
Kidneyfat proportion	%	2,2a	2,9b	3,3b	14,56**	2,3	2,9	2,9	2,1	2,9	3,5

*) The mean values marked with unequal letters differ significantly of each other ($p<5$ %)

Table 2: Mean values of the fattening and slaughter yield - GG x (Russian x WN)

Weight class						male			female		
		1	2	3	F-values	1	2	3	1	2	3
Number of animals	n	50	30	30		25	15	15	25	15	15
Age at begin.of fatten.	days	28	28	28		28	28	28	28	28	28
Weight " " "	g	521	535	536	1,46	520	533	534	524	537	539
Weight at end of Fatten.	g	2895a	3059b	3201c	251,46**	2894	3037	3206	2897	3081	3202
Fattening period	days	59,2a	62,9b	65,4b	6,94**	60,2	61,6	65,3	58,2	64,2	65,5
Daily gain	g	40,4	40,0	40,2	1,92	39,8	40,4	40,3	41,0	39,6	40,1
Daily feed consumption	g	141,4a	145,5b	148,0b	6,01**	142,8	146,9	150,7	140,1	145,1	146,4
Food efficiency	kg	3,52a	3,63b	3,68b	6,52**	3,61	3,63	3,71	3,43	3,62	3,65
Slaughter yield, hot	%	58,4	58,1	59,0	2,64	58,8	58,6	59,2	58,0	57,6	58,7
Slaughter yield, cold	%	56,5a	56,9ab	57,5b	4,89*	56,8	57,5	57,7	56,1	56,3	57,3
Pelt proportion	%	15,4a	16,0b	15,6b	3,69*	15,4	16,1	15,4	15,3	15,8	15,8
Head proportion	%	7,1a	7,0a	6,8b	4,47*	7,3	7,3	6,9	7,0	6,8	6,6
Kidneyfat proportion	%	2,6a	3,4b	3,4b	9,54**	2,7	3,1	3,3	2,5	3,6	3,5

*) The mean values marked with unequal letters differ significantly of each other ($p < 5\ \%$)

Table 3: Mean values of the cuts and edible offals as percent

cause of variance		n	Slaughter weight	leg	back	belly	fore leg	leg	fat	kidney	heart	liver	meat/bone ratio
White New Zealand (WN)													
female	2,6	6	1368,3	33,5	22,6	10,0	10,9	12,2	2,5	1,3	0,6	5,2	4,78
	2,8	6	1481,8	32,9	22,9	10,6	11,4	11,8	2,7	1,3	0,6	5,1	4,79
	3,0	6	1563,6	31,4	24,0	10,4	12,0	11,5	2,9	1,3	0,5	5,6	4,46
male	2,6	6	1363,5	33,6	23,5	9,5	11,4	12,5	2,4	1,3	0,5	4,7	4,80
	2,8	6	1533,4	32,5	22,8	10,4	12,2	11,5	2,7	1,4	0,6	5,5	4,83
	3,0	6	1643,2	31,8	23,1	11,2	13,1	10,6	3,3	1,2	0,5	4,9	4,84
total		36	1492,3	32,6	23,2	10,4	11,8	11,7	2,7	1,3	0,5	5,2	4,75
DRx(Russian x WN)													
female	2,8	6	1482,8	32,6	23,0	9,1	11,8	12,2	3,2	1,3	0,6	5,5	4,36
	3,0	6	1623,7	33,5	23,6	9,5	11,1	12,0	3,5	1,1	0,6	5,0	4,51
	3,2	6	1747,8	34,5	22,8	10,6	10,9	11,3	3,3	1,2	0,6	4,6	4,89
male	2,8	6	1502,4	33,2	22,7	9,2	12,1	12,3	3,3	1,2	0,6	5,0	4,76
	3,0	6	1643,7	33,1	24,1	10,2	11,4	11,4	3,5	1,1	0,6	4,1	4,77
	3,2	6	1789,8	33,8	23,5	9,8	12,2	11,1	3,5	1,2	0,6	4,5	5,14
total		36	1631,7	33,4	23,3	9,7	11,6	11,7	3,4	1,2	0,6	4,8	4,73
			F - v a l u e s										
	FG												
sex	1		5,74*	0,02	0,01	0,00	4,29*	1,42	0,14	0,32	0,60	1,31	2,41
final fat.weight	2		61,42***	6,10**	0,67	2,57	5,05*	7,41**	1,76	1,41	6,32**	0,87	1,05
Interaction	2		1,99	0,28	1,04	1,11	0,26	1,38	0,37	2,37	0,84	1,87	1,45
sex	1		2,96	0,22	0,48	0,01	3,26	1,55	0,18	0,00	0,03	10,08**	10,05**
final fatt.weight	2		102,64***	3,44*	2,48	5,64**	0,98	7,95**	0,41	4,29*	0,15	8,57**	8,19**
Interaction	2		0,22	0,97	0,59	2,71	1,05	0,66	0,07	0,53	0,05	2,24	0,26

Table 4: Mean values of the tissue proportion of the cuts leg and baack as percent

cause of variance		n	leg meat	leg bone	leg tenden	leg inter-muskular fat	back meat	back bone	back tenden	back inter-muskular fat
White New Zealand (WN)										
female	2,6	6	75,9	16,0	2,4	3,7	69,1	17,4	5,5	4,4
	2,8	6	74,8	15,7	2,3	5,2	68,9	16,3	4,8	6,2
	3,0	6	75,2	16,9	2,2	4,8	65,1	18,5	5,3	7,3
male	2,6	6	76,4	16,0	1,8	3,5	69,7	18,5	3,7	4,2
	2,8	6	75,6	15,6	2,6	4,5	69,1	17,4	4,2	6,3
	3,0	6	76,1	15,7	2,2	4,2	65,6	17,4	5,9	6,7
total		36	75,7	16,0	2,2	4,3	67,9	17,6	4,9	5,8
DR x (Russian x WN)										
female	2,8	6	73,8	17,0	1,7	5,4	70,7	17,7	2,4	4,5
	3,0	6	72,1	16,1	2,3	7,4	68,6	15,4	5,9	7,6
	3,2	6	73,2	15,0	1,9	8,0	70,9	16,1	4,1	5,6
male	2,8	6	74,9	15,7	2,1	5,2	70,4	17,3	4,1	4,5
	3,0	6	74,0	15,5	2,5	5,2	71,2	13,9	4,4	6,2
	3,2	6	74,7	14,6	2,4	6,6	71,5	15,5	3,5	6,9
total		36	73,8	15,7	2,2	6,3	70,6	16,0	3,9	5,9
						F-values				
		FG								
sex		1	4,60*	1,64	0,19	1,36	0,19	0,80	2,14	0,11
final fat.weight		2	2,83	1,44	0,82	4,59*	6,92**	3,31	3,08	5,06*
interaction		2	0,12	1,65	1,82	0,12	0,01	3,41*	2,60	0,10
sex		1	6,89*	7,13*	4,37*	4,61*	0,26	3,76	0,44	0,01
final fat.weight		2	1,64	11,11***	3,08	4,06*	0,51	14,97***	7,45**	5,70**
interaction		2	0,17	0,88	0,23	1,12	0,40	0,76	6,08	1,58

Table 5: Mean values of physical criteria

cause of variance		n	leg pH-value	leg color	leg +b	back pH-value	back color	back +b	back liquidance	grill loss %	Warner-Bratzler
White New Zealand (WN)											
female	2,6	6	5,53	46,2	11,9	5,72	52,1	9,3	8,4	26,1	2,7
	2,8	6	5,45	59,2	13,1	5,68	51,2	12,8	7,3	20,7	2,7
	3,0	6	5,42	64,2	9,3	5,75	53,8	10,8	8,5	28,2	3,3
male	2,6	6	5,56	52,8	10,9	5,68	57,3	8,3	9,1	23,7	2,2
	2,8	6	5,49	59,6	10,7	5,65	51,2	8,0	9,0	25,2	2,4
	3,0	6	5,44	58,1	11,9	5,77	54,1	10,0	8,6	24,3	3,2
total		36	5,48	56,7	11,3	5,71	53,3	9,8	8,5	24,7	2,7
DR x (Russian x WN)											
female	2,8	6	5,35	50,5	9,4	5,71	63,7	8,0	7,4	26,0	3,1
	3,0	6	5,49	62,7	8,5	5,85	56,7	10,9	7,9	24,4	2,0
	3,2	6	5,42	53,4	10,1	5,76	55,1	7,6	6,5	22,1	1,9
male	2,8	6	5,29	60,1	11,4	5,61	62,3	8,8	8,0	23,3	2,5
	3,0	6	5,63	40,6	10,8	5,90	46,0	8,1	6,7	23.2	1,7
	3,2	6	5,42	58,8	10,7	5,71	55,0	8,6	7,2	20,8	1,7
total		36	5,43	54,4	10,2	5,76	56,4	8,7	7,3	23,3	2,1
		FG	F - values								
sex		1	1,58	0,03	0,69	0,14	1,73	123,15***	9,92**	0,18	1,79
final fat.weight		2	7,00**	18,20***	6,52**	1,77	2,47	28,70***	1,48	1,79	3,66*
interaction		2	0,06	4,74**	24,76***	0,24	1,57	40,68***	2,68	3,31	0,18
sex		1	1,49	2,17	31,75***	1,03	7,24*	2,01	0,10	1,62	4,23*
final fat.weight		2	46,48***	2,99	2,93	17,45***	20,94***	14,06***	4,47*	2,01	13,76***
interaction		2	7,90**	38,61***	3,46*	1,97	4,94*	28,10***	7,98**	0,12	0,48

Table 6: Mean values of the chemical composition (percent) and of the sensory data - leg muscle

cause of variance		n	water	ash	fat	protein	juici-ness	tender-ness	flavor	overall impression
White New Zealand (WN)										
female	2,6	6	74,7	1,24	1,30	22,8	3,2	4,0	2,7	2,9
	2,8	6	75,1	1,23	1,45	22,3	3,8	3,7	2,3	2,5
	3,0	6	75,7	1,27	1,31	22,0	3,1	3,4	2,6	2,7
male	2,6	6	74,3	1,35	1,90	22,4	3,4	3,9	2,3	2,4
	2,8	6	75,3	1,29	1,31	22,4	3,5	4,0	3,3	3,4
	3,0	6	75,2	1,34	1,34	22,5	3,3	3,3	2,6	2,7
total		36	75,0	1,29	1,44	22,4	3,4	3,7	2,6	2,7
DR x (Russian x WN)										
female	2,8	6	74,2	1,24	1,21	23,4	3,0	3,5	2,5	2,5
	3,0	6	75,8	1,21	1,11	22,0	3,5	4,2	3,0	3,1
	3,2	6	74,8	1,28	1,49	22,7	3,3	4,0	3,3	3,4
male	2,8	6	74,2	1,28	1,51	23,1	2,5	3,3	2,3	2,4
	3,0	6	74,7	1,26	1,09	22,9	3,3	4,0	2,5	2,6
	3,2	6	74,8	1,27	1,20	21,7	3,2	4,0	3,3	3,2
total		36	74,8	1,26	1,27	22,8	3,1	3,8	2,8	2,9
		FG	F - v a l u e s							
sex		1	2,27	100,77***	1,53	0,28	0,02	0,05	1,18	1,20
final fat.weight		2	15,17***	11,04***	1,73	4,77*	4,54*	9,01***	0,98	1,63
interaction		2	2,38	4,24*	3,05	6,25**	1,53	0,78	5,34*	7,49**
sex		1	5,27*	11,32**	0,00	2,94	11,47**	2,99	2,88	5,06*
final fat.weight		2	17,69***	6,35**	2,61	12,50***	25,48***	18,13***	12,80***	19,14***
interaction		2	6,46**	4,30*	2,58	7,71**	1,52	0,41	0,63	0,73