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The influence of the inbreeding level on the indices of reproductory and meat production utility in rabbits

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The mating of animals has been in practice for centwies in order to accumulate genes that result inhigh production. In rabbit breeding mating can go back several generations (Chai, 1969; Fox,1978). However, one must take into account the possibility of inbreeding depression which can occur as early as the second generation. It is very important to determine to what extent inbreeding influences rabbit production since in a definite majority of Polish farms there is not much interest in mating and frequently mating of closely related animals occurs either consciously or unconsciously. Production is therefore often lowered.

For this reason research was undertaken on the influence of inbreeding on rabbit reproduction and carcass values.

Materials and metods

The experiment was carried out on the rabbit farm of the Chorzelow Animal Science Research Station Farm, belonging to the Institute of Animal Science. White New Zealand rabbits, which are recommended for breeding in Poland (Kopanski, 1980; Niedzwiadek, 1983) and which are bred widely throughout western Europe (Auxilla, 1970; Fisher, 1978) were used. The animals, from 2211 litters, differed as to their inbreeding coefficients. They were divided into 7 experimental groups: Group I - F_x=0,0312; II - F_x=0,0625; III - F_x=0,125; IV - F_x=0,25; V - F_x=0,25; VI - F_x=0,375; VII - F_x=0,5. The inbreeding coefficient F_x was calculated according to Wright (Maciejowski, Zieba, 1972). Animals from groups I-IV were the result of mating father with offspring (daughter, granddaughter, etc., while animals from Groups V-Vii, from mating siblings in the following generations.

The rabbits were kept in buildings with a regulated microclimate and were ensured constant access to water with automated watering. They were fed complete feed, a granulated product of the Chorzelow Animal Science Experimental Station (Kopanski, 1980).

During the experiment male mating efficiency was recorded, as well as the number of rabbits born per litter. Within 24 h the litters were weighed in order to determine the body weights of the newborn.

The rabbits were fattened after weaning i.e. from day 35 after birth. The rabbits were weighed individually at the beginning and end of fattening, at 90 days. During fattening deaths and amounts of feed consumed were recorded.

Statistical calculations underwent variance analysis (Ruszczyc, 1970).

Results and discussion

Group I had a mating efficiency of 49% (Table 1). As the inbreeding coefficient increased there was a similar increase in mating efficiency, reaching 62% in group IV. Futher increases in the degree of inbreeding resulted in decreased breeding efficiency, falling to 46% in groups VI and VII. In group V, where the rabbits had the same inbreeding coefficient of F_x=0,25 as in group IV, a lower percent breeding efficiency (51%) was found. These animals came from mating siblings. Ow mating efficiency was lower than that of Nitt and Lukefahr (1983).

Litter size at birth, from 6,8 to 7,9, was similar to Harris et al. (1982). Group II had yhe smalltest number of live births (6,7). As statisticaly significant difference was high and significant.

Groups III-V had the highest newborn body weights. They varied from 58,0g in group V to 59,0g in group IV. The remaining groups had low body weights (49,0g in group VII to 56,6g in group II). The newborn body weight differences were significant and highly significant statistically. The body weights that we recorded were somewhat smaller than those found by other authors for the same rabbit breed (Niedzwiadek, 1983; Schlolaut, Lange, 1979).

The mean body weight of young 35-day-old rabbits at the beginning of fattening ranged from 606g in group I to 746g in group V (Table 2).

At the end of fattening the lowest body weights of 90 day-old rabbits were in group I-1888g and VII-1975g. Groups IV and V had the heaviest weights (2127g and 2203g, respectively). Bednarz et al. (1973) and Bombeke et al. (1975) give body weights, approximately 100g heavier, for the same breed and at the same age.

The mean daily weight gains during fattening increased simultaneously with the inbreeding coefficient, reaching maximums of 26,4g in groups IV and 26,6g in V where F_x=0,25. With greater inbreeding daily gains declined to 24,4g in group VII.

Feed consumption for 1kg body weight gain ranged from 3,7kg in groups I, II and VII to 3,9kg in groups III, IV and V. This was somewhat higher than that recorded by other authors (Niedzwiadek, 1983; Schlolaut and Lange, 1979). With increased inbreeding, feed consumption decreased from 0,1 to 0,2kg. This was associated with a slower grawth rate in very inbred animals. Growth rate is negatively corelated to feed consumption and the correlation coefficient between these traits varied from 0,4 to 0,5 (Heckman et al., 1971).

Deaths in young rabbits were as follows: group I-31%, II-30%, III-25%, IV-18%, V-19%, VI-25% and VII-34%. Deaths definitely increased when the degree of inbreeding was greater than F_x=0,25. Probably the greater percent of deaths was due to lowered resistance associated with inbreeding.

Conclusions

The following conclusions can be made:

1. Fertility and fattening coefficients in rabbits increased together with increased inbreeding, up to F_x=0,25.
2. Further increases in inbreeding, from F_x=0,25 to F_x=0,5, resulted in definitely lowered rabbit production.
3. An acceptable degree of inbreeding in rabbits is F_x=0,25.

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Table 1.

Indices of reproductive performance of does.

Groups*	Conception rate	Litter size (born alive)		Weight at birth (g)	
		$\bar{x}$	v	$\bar{x}$	v
I	49	6,8 ADEF**	22,1	50,4 ABbcdg	16,2
II	50	6,9 CGHIa	23,2	56,6 achi	14,3
III	60	6,7 BJKLa	22,1	58,9 BCbj	15,8
IV	62	7,4 ABCMbc	21,3	59,0 AEalk	16,3
V	51	7,9 DGJM	20,7	58,0 Ded	17,3
VI	46	7,8 EHKb	21,4	54,0 efghjlk	16,1
VII	46	7,8 FILc	22,3	49,0 CDEfi	15,8

Groups*: I - F_x=0,0312; II - F_x=0,0625; III - F_x=0,125; IV - F_x=0,25; V - F_x=0,25; VI - F_x=0,375; VII - F_x=0,5.

**Means followed by the same small letters are significanty different P 0,05, by capital letters P 0,01 show highly significant differences.

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Table 2.

Body weight of young rabbits

Groups*	Body weight, age (days) 35		90		Body weight gain during day (g)	Food intake per 1kg of live weight gain
	$\bar{x}$	v	$\bar{x}$	v		
I	606	22,5	$1888^{ABCDE**}$	11,1	21,6	3,7
II	625	29,2	2026^{CFa}	13,4	25,4	3,7
III	652	25,1	2072^{BGd}	16,0	25,8	3,9
IV	656	26,9	2127^{AHa}	16,0	26,4	3,9
V	746	18,8	2203^{DFGb}	13,6	26,6	3,9
VI	641	21,6	2091^{Ebc}	15,6	26,3	3,8
VII	631	21,1	1975^{Hcd}	16,3	24,4	3,7

*and** - for explanation see Table 1.