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FURBEARING ANIMALS AND PET ANIMALS**

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SECTION : REPRODUCTION

**Reproduction management
for rabbit meat production.**

J. PETERSEN (Germany)

In rabbit meat production the purchase of young rabbits is, for economical reasons very important, since the costs, especially at low final body weights, almost equal feed costs. In order to minimise costs a high number of slaughtered rabbits per doe is desired. This objective can be achieved by trying to obtain high conception rates after insemination, high litter size and low mortality, short kindling interval and long service life.

Present replacement and rearing practise should be reconsidered in order to increase service life of the does. Conception rates are highly variable under field conditions. Some factors influencing ovulation rate, embryonic mortality and litter size are presented from the literature.

Balancing litters among does littering at the same time can reduce significantly the mortality among young rabbits. But prenatal performance of the doe should be considered besides of the number of teats when balancing litters.

Number of young rabbits produced per doe and year is strongly affected by the mating scheme. In Europe different schemes are practised but the 42-day scheme is dominating more and more. The optimal point of weaning depends on the mating scheme.

**The effect of frequent ejaculation on the reproductive
performance of males in rabbit.**

K. BODNÁR, E. BODNÁRNÉ SKOBRÁK
M. VRAZSOVICS (Hungary)

The effect of frequent ejaculation was studied on the volume, the mortality, the concentration, the vitality and the fertility of the rabbit semen. 30 Pannon White bucks were divided in 3 groups. In the group A the semen was collected once in every three days, in the group B once daily, and in the group C only on one day until exhaustion.

In the group A every buck was always ready for copulation. On the 27th day of the study period, there was no male to show inclination to in group B. All the traits were gradually decreased

in group B by the time. Significant differences were found between group A and the frequently ejaculated group B in the volume (0,79 and 0,54 ml), concentration (286.14×10^6 and 231.66×10^6 spermatozoa/ml) and percent of living spermatozoa (78.6 and 73.2%) of semen, but not in the mortality (4.00 and 3.19).

The males of the group C ejaculated successively 4 times in average. The semen was used for insemination, and the conception rate and litter size didn't changed significantly due to the frequent ejaculation.

**Influence of exogenous oxytocin post insemination (p.i.)
on the litter size in rabbits.**

K. HOFFMANN, M. GAULY, H. MATHIAK, K. LANGE
G. ERHARDT (Germany)

With the housing of rabbits in great herds, the artificial insemination has become an important biotechnology. Especially in connection with the artificial insemination, the stimulation of muscle contractions is very important, which oxytocin induces in oestrus on the smooth muscle of the female genital tract. These contractions accelerate the passive sperm transport and thus optimise the results of the artificial insemination.

The aim of the study was to proof with 59 White New Zealand, if exogenous oxytocin application after the artificial insemination can increase the litter size or the conception rate in rabbits. In addition the birth weight and the number of dead and living new-borns were recorded. The animals were inseminated two days after the kindling, afterwards treated with 10 I.U. Oxytocin i.m. or intravaginal and assessed in comparison to an untreated group. The experiment was five times repeated.

Results show, that the exogenous oxytocin treated rabbits had an 1,14 greater litter size, than the untreated control group ($P < 0.05$). Concerning to the conception rate exogenous oxytocin showed minimal, non-significant effects ($P > 0.05$). The birth weight and the number of dead and living new-borns were not influenced by treatment.

In an additional experiment the effect of carbetocin (Depotocin[®]) were examined. An i.m. injection improved the litter size (+1,24) in comparison to oxytocin and may supposed a higher effect on the sperm transport than oxytocin.

Effects of age and milk production of does and birth weight of the kits on weight development during fattening.

R. VASQUEZ, J. PETERSEN, L. MENNICKEN (Germany)

Data derived from 819 kits delivered by 90 does in three consecutive trials were analysed using a multifactorial model with fixed effects only. Litters were balanced completely by litter weight and litter size on day 33 after insemination. Thus pre- and postnatal performance of the does on body weight development of the kits can be quantified separately for the first time. Traits analysed were milk production of the nursing doe and daily gain of the kits during different phases of the fattening period (1 to 12 weeks of age).

Birth weight of kits from young does is lower (-3.8g) compared to birth weight of kits from old does (≥ 3 rd litter). The age related effect of the delivering doe or mother (i.e. birth weight of the kits) on daily gain of the kits is relatively constant over the first 10 weeks of age. Young does (1st litter) produce up to 43g of milk less per day during peak production than old does do. The age effect of the nursing does (= postnatal performance) increases until the end of the third week of suckling and is threefold compared to the age effect of the mother (= prenatal performance). Thereafter the age related effect of the nursing doe decreases and is smaller than the age related effect of the mother from wk 8 to 9 onwards. During the last two weeks of the fattening period no significant age related effect of the does (nurse or mother) on daily gain of the kits can be detected. Kits with higher average birth weight within litter demonstrate significantly higher daily gains until week 8. Only during the last two weeks of the fattening period compensatory growth can be detected. Age related effects of the does and differences in birth weight within litter can not be fully compensated until the end of the fattening period in week 12.

Body weight development and milk yield of hybrid does during the first three weeks of lactation depending on feeding intensity.

J. HARTMANN, J. PETERSEN (Germany)

A study was conducted to examine the effects of restrictive feeding during the rearing period on the following reproduction performances of does concerning the first three litters. Restricted feeding during rearing was compared to usually applied *ad libitum* rearing (control group). 257 ZIKA-hybrid does were randomly assigned to one of two feeding groups. Average daily feed intake of the restricted group reached 68,5% of the feed intake of the control group. From the 14th days before first insemination "restricted" does were fed *ad libitum*. First insemination was done on an average of 115 days. Following inseminations were conducted at 42-days-intervals. The number of kits per litter were balanced on day 33 after insemination. Primiparous does got 8, does with more than one litter got 9 kits. Weight gain from litters balancing out to the 21st day of the suckling period after the balancing was used as an estimation of does milk yield.

From an average primiparous life weight of 3,86kg vs 3,76kg (control group vs restricted) all does showed a considerable life weight gain up to the third litter. Immediate after third litter restricted reared does were heavier than *ad libitum* reared ones (4,66kg vs 4,52kg).

All does showed remarkable weight gains during the observed part of the suckling period (day of litter balancing out up to 21st day after litter balancing - first litter: +485g, second litter: +426g, third litter: +393g).

Restricted reared does achieved higher milk yield, measured by the kits development. Litters weight gain was higher for the restricted than for the control group and increased continuously from litter to litter (first litter: +23g, second litter: +206g, third litter: +267g). Restricted rearing of the does significantly increased young's weight at 21st day of the suckling period (402g vs 379g of young of the control group).

Investigations on suckling behaviour in rabbits.

K. SEITZ, S. GUTKOSKI, K. LANE, ST. HOY (Germany)

The aim of the investigations was to register the suckling behaviour in various rabbit-breeds and hybrids and in different keeping systems with an Infrared-Videotechnique at some days during the suckling period over 24 hours. The comparing investigation in a flatdeck, in a two-level-cage with a higher laying area ("Swiss system") and in a greater flatdeck area should answer the question to what extent there is a specific species mother-child-relation in different keeping systems. The behavioural observations are aimed at the assessment of cage keeping systems for rabbits from the viewpoint of animal protection and welfare.

The whole investigation included the evaluation of 6x135 videotaped 24-h-days (flatdeck, "Swiss system") of 54 rabbit litters and 242x24h-series of 34 rabbit litters in the greater flat-deck. During the four weeks rearing of the kits we made a continuous 24h Videotaping of six boxes (mother and litter), which gave the possibility of a complete measuring of all suckling periods. The frequency of suckling/24h, the duration of suckling and the moment of suckling were determined, also the milk intake per suckling event and the individual live weight development during the suckling period. Three different keeping systems with a different cage area for the mother (0,3m; 0,35m + higher laying area; 0,8m), four different breeds or hybrids (White New Zealand, ZIKA, Bauer and Richter hybrids) and two different light programs (artificial light program: 11,5 hours light period, 12 hours darkness and 2x0,25 hours dusk and down; natural light) were investigated.

In observations of about 1000 24h-periods it was found, that the frequency of suckling is greater than once a day (up to 6 in 24h) with an average of 1,53 and a high significant difference between the keeping systems flatdeck (34,8% of the days with 2 suckling events), "Swiss system" (41,6%) and the greater flatdeck area (56,6%) and between the breeds or hybrids White New Zealand (36,2%), ZIKA (53,2%), Bauer (45,8%) and Richter hybrids (53,8%).

In opposite to the existing view that the several suckling during 24h is a consequence of a reduced cage area, it was observed an increase percentage of several suckling in larger cages.

It could be detected that the suckling activity is subject to a circadian rhythm. In the rounds with artificial light regime a peak between 5 and 6 p.m. (transition from bright to dark) and a little rise of the suckling activity in the early morning hours were found. In the rounds with natural light the peak of suckling events postponed from 7 p.m. (March/April) to 10 p.m. in July (natural dawn).

Impact of the coat length on the performance of Angora doe rabbits.

C. EIBEN, ZS. SZENDRŐ, D. ALLAIN
R.G. THÉBAULT, I. RADNAI, E. BÍRÓ-NÉMETH,
J. LANSZKI (Hungary-France)

To study the heat stress effect caused by long wool on Angora does reproduction, 57 nulliparous litter mate German Angora does were divided in two groups. In the first group (A) the does were totally shorn once, one week before each artificial insemination. In the second group ("A") after an initial coat shearing to about 1.5 cm of length, the does were shorn every 2 weeks in order to maintain the wool at 2.0 to 2.5 cm which is the coat length of normal hair rabbit. The performance of 51 nulliparous normal hair Pannon White (N) rabbits was also tested for a comparison of only genetically different N and "A" does. In connection with the probably better feed intake "A" females, were 3,2% heavier compared to A ones. Due to better general condition, total loss from illness or death was 54,8% in A, and only 26,9% in "A" does which led to a longer productive lifetime of "A" rabbits. Kindling rate was not significantly different in groups N, "A" and A. Total litter size at birth was 9.0; 7.5 and 6.5 in N, "A" and A females, respectively. Total litter loss was lower in "A" and N does, but considerably higher in group A. Kits suckled by "A" does significantly surpassed their counterparts nursed by A ones in 21 days litter weight, individual weight at 21 and 42 days of age and daily weight gain between 3 and 6 weeks. Group N was always superior to group "A" with respect to these traits.

It was concluded that the heat stress caused by the long wool had a negative impact on reproductive traits. By means of continuous shearing the performance of Angora does can be successfully improved. However, the significant differences between groups N and "A" regarding all traits indicate that the weaker prolificacy of Angora rabbits is also related to the genetic factors of the breed.

SECTION : BREEDING

Growth performance and carcass traits of purebred and crossbred rabbits.

B. RÖSSLER, G. SEELAND (Germany)

In this experiment two large (Grey Giant, Flemish Giant) five medium-sized (Champagne d'Argent, Giant Chinchilla, New Zealand White, Belgian Hare, Californian) and two small breeds (Dutch, Russian) were investigated.

At the end of the fattening period (84th day of life) the live weight of the large breeds was 3465 and 3409g, respectively. The Champagne d'Argent had heavier weight than the other medium-sized breeds. The dressing percentage of Dutch and Russian small breeds with 65,0% and 64,6%, respectively. At this level was also the Belgian Hare with 64,3% which showed a very favourable pelt percentage of 14 %. The New Zealand White presented the lowest dressing and highest pelt percentage of 60,3% and 16,5%, respectively. The percentage of edible meat varied from 48,3% with the New Zealand White to 52,0% with the Belgian Hare. The suitability of the breeds for production was estimated, based on the living weight at 84th day of life.

Multiple comparisons of seven genetic lines of rabbits for body weight, daily weight gain and feed conversion efficiency.

R.Y. NOFAL, S. TÓTH, GY. VIRÁG (Hungary)

Progenies from New Zealand White (NZ), Californian (C) and German Large White (GL) as pure breeds as well as NZxC, CxNZ, GLxF1 and F2 as crossbreeds were used in this experiment during fattening period after weaning until 12 weeks of age.

NZ purebred progenies had the heaviest body weight at different ages except at weaning, but did not differ significantly from the NZxC crossbred rabbits followed by terminal cross (TX). The F2 crossbred progenies were lighter than the F1 ones and the purebred group had the lightest body weight at all ages.

NZ purebred rabbits had the fastest daily weight gain followed by terminal cross (TX) but did not differ significantly from the GL and CxNZ progeny. Through the fattening period, the gain of F2 crossbred rabbits were similar to the F1 cross of the two pure breeds; the C purebred had the slowest growth rate. The differences were high significant among breed-groups in body weight and daily weight gain.

NZ purebred rabbits were the best one in food utilisation followed by NZxC crossbred and the C purebred had the worst feed conversion efficiency. No significant differences were found among breed-groups for feed conversion efficiency. Crossbreeding slightly improved the feed conversion efficiency when C does were sired by NZ bucks.

The 1st parity had the best results for body weight at different ages and daily weight gain while the 3rd was better than the 1st in feed conversion efficiency.

No significant differences were observed between males and females at all ages for all traits till 12 weeks of age except daily weight gain which was better in males (8-10 weeks of age).

Estimates of direct and maternal heterosis percentages (H^E_{NZxC} and H^M_{NZxC}) body weight, daily weight gain and feed conversion efficiency were 2.4, 1.4 and -1.6; -1.4, -1.1 and 0.3%, respectively over the whole period (6-12 weeks of age).

Influence of frequent manipulation on broiler rabbit growth utility.

J. RAFAY (Slovakia)

The effect of permanent manipulation on growth and feed conversion were studied in a population of 50 rabbits of paternal line P91 during 56 days of fattening in the period from 28 to 84 days. The animals were removed from their cages in the same stable, 3 times daily. The control group was housed in identical technological conditions without manipulation.

Arithmetical means with variance characteristic (standard error - s_x) were calculated from the gained values of growth intensity and feed consumption. We determined the significance of manipulation effect on the studied parameters by one way variance analysis.

The results show that the frequent manipulation did not influence the live weight growth. However, the average feed conversion efficiency was significantly higher in most one week intervals for manipulated animals with the exception of 9th, 10th and 12th fattening week.

**The effect of breed and crossbreeding
on the digestive tract measurements in rabbits.**

Z. WÓJTOWICZ, J. BIENIEK, B. GOROL, J. LISIECKA;
Z. STALINSKI (Poland)

The investigations were carried out on 206 New Zealand White, Black Ten (Silver Marten) and reciprocal crossbred rabbits. The observations were carried out on rabbits at the age of 70 and 140 days. Measurements of particular parts of digestive tracts were taken and the effect of genotype, age and sex was evaluated by multivariate analysis of variance. For parameters of digestive tract there were significant differences observed between different genetic systems of mating. For the majority of investigated parameters expressed per 100 grams of body weight significant differences were observed between age groups.

**Effect of genetic and environmental factors
on fattening performance of rabbits.**

P. BIELANSKI, ST. NIEDZWIADK, J. ZAJAC (Poland)

The aim of the studies was to determine the effect of genotype, various feeding systems (pelleted and farm-produced feeds) and season on selected indicators of fattening performance in rabbits. New Zealand White, Termond White, Grand Chinchilla, Californian and Alaskan rabbits from weaning to 2500g body weight were kept in open-air cages in the spring-summer and autumn-winter seasons. The rabbits were found to have rapid growth rate in both seasons. Daily weight gains ranged from 28.3 to 38.2g, with different feed conversion ratios (3.4 to 4.2kg). There were differences in genotypes in terms of the fattening characteristics. New Zealand White and Termond White rabbits had the fastest growth rate on pelleted feed. In the spring-summer season the weight of 2500g was achieved the soonest by White Termond (oo-pellet feeding), New Zealand White (oo-pellet feeding), Californian (o-pellet feeding) and Alaskan (o-conventional feeding) rabbits; in the autumn-winter season by New Zealand (oo-pellet feeding, o-conventional feeding), Termond White (oo-pellet feeding), Grand Chinchilla (o-pellet feeding) and Alaskan (o-conventional feeding). Fattening in the autumn-winter season had no adverse effect on the growth rate of rabbits.

**Reproductive performance and growth rate
of young rabbits of a specialised meat line.**

D. KOWALSKA, ST. NIEDZWIADK, P. BIELANSKI (Poland)

The results of reproductive performance and growth rate of young rabbits of a specialised meat line, obtained from selection of maternal and paternal lines, are presented. Females from the maternal line N-1, selected for reproductive traits, were terminally crossed with rabbits from the paternal line N-2, selected for two traits: daily body weight gain and feed conversion. Litter size was an average of 8.16 rabbits at birth and 7.80 at weaning. The milk yield coefficient was 4.0 and the reproductive performance coefficient was 15. Young rabbits of the specialised meat line had daily weight gains of 32-36g, and rabbits until 90 days of fattening consumed 3.51kg per 1kg weight gain. At the end of the fattening the mean body weight of young rabbits was 2857g. Further selection is

carried out to increase daily weight gains and to reduce feed conversion ratio of young rabbits.

**SECTION : NUTRITION, PHYSIOLOGY,
FEEDING**

**Effect of restricted feeding of growing rabbits
on fattening performance and carcass quality.**

B. CHRIST, K. LANGE (Germany)

By using *ad libitum* feeding with pelleted feeds for growing rabbits, the highest part of dietary energy will be transferred into body fat and the low part into body protein. It is possible that these rabbits will get a high fat content and moreover the feed conversion efficiency, regarding to weight gain, is low, because the needs for maintenance will be increased.

The aim on this study is to examine, from which age and in which intensity a restricted feeding influences live weight and fat content as well as fattening performance and carcass quality of growing rabbits.

ZIKA-hybrid-rabbits (28 days old) were divided into different groups (30 rabbits each group). Feeding restriction intensity of different groups was different in view of amount of feed and age of rabbits at beginning. A commercial pelleted rabbit diet was used. Body weight and feed intake were examined weekly. Rabbits were slaughtered at a live weight of 3kg and carcass quality was ascertained.

Restricted feeding resulted in lower feed intake and decreased daily weight gain. To get a live weight of 3kg a longer fattening period was necessary, affected by intensity of feeding restriction. An improved feed conversion efficiency by restricted feeding was not confirmed in all groups. In view of carcass quality a low carcass yield was ascertained in restricted fed rabbits in connection with a low fat content, determined the by amount of kitney fat of the carcass.

**Effect of some probiotics on digestibility
of nutrients in rabbits**

A. KERMAUNER, M. STRUKLEC (Slovenia)

The effects of three different probiotics: Toyocerin 10¹⁰ (spores of *Bacillus toyoi*), Paciflor (spores of *Bacillus CIP 5832*) and Yea-Sacc (yeast *Sacharomyces cervisiae*) on nutrient digestibility in 24 male New Zealand rabbits were studied. Digestibility trial was performed after European reference method for *in vivo* determination of diet digestibility in rabbits, but with 6 animals per diet and 10 days long collection period. Trial feeds were made from control feed (C) with addition of 0.01% Toyocerin (T), 0.01% Paciflor (P) or 0.1% of Yea-Sacc (Y).

Digestibility of dry matter, organic matter, crude protein, N-free extract and energy did not differ between groups. Some differences between digestibility of diets were observed in digestibility in crude fibre (C: 24.17^a, T: 27.54^{ab}, P: 31.38^b and Y: 22.02^{a%}), crude fat (C: 84.46^a, T: 80.61^{ac}, P: 76.92^{bc}, Y: 74.71^{b%}) and especially in crude ash digestibility (C: 54.44^a, T: 63.17^b, P: 63.46^b, Y: 62.40^{b%}).

Reduction of abdominal fat in rabbits with increasing protein content in feed.

J. ASKOV JENSEN (Denmark)

The purpose of the experiment was to reduce fat content in the carcass of rabbits, as abdominal fat degree tends to increase in the herd at Research Centre Foulum. Increasing protein content in feed results in enhanced secretion of urea via the kidneys. This process requires energy, which is taken from the energy reserves of the body, thus resulting in less energy for other body functions such as building up fat depots. A total of 471 rabbits of Danish White Land were distributed on two experimental trials of 3 treatments:

Trial 1	No.	Protein content	FU/100 kg
A. Control	81	17.0% protein	80.5
B. Treatment	78	21.6% protein	81.2
C. Treatment	72	23.4% protein	80.8
Trial 2	No.	Protein content	FU/100 kg
D. Control	80	17.0% protein	80.5
E. Treatment	90	17.0% protein	77.1
F. Treatment	78	24.3% protein	81.2

At the highest level of protein, the body fat content was reduced in both trials by 16 and 12%, respectively.

The increased protein content caused an increase in feed consumption per kg gain of 30% in trial 1 and 14% in trial 2, whereas daily gain dropped by 4.1 and 3.6%, respectively. Mortality rate also raised with increased protein content peaking with 8% dead in trial 1 treatment C and 9.3% dead in trial 2 treatment F, which is 1.7 and 2% more than with the control-fed, respectively.

Results showed that reduction in abdominal fat upon high protein content in the feed is possible in rabbits, but it has many other implications.

Effect of increased zinc supplementation in chelat form on production parameters in rabbits.

M. STRUKLEC, A. KERMAUNER (Slovenia)

From 10th day of lactation, sixty New Zealand rabbit does were fed standard feed (172 CP; 165 CF; 345 NDF; 209 ADF; 17.2Ca; 7.9 P; 3.4 Na g/kg of feed and 292 mg Zn/kg of dry matter-DM) and with enriched feed for lactating does (228 CP; 128 CF; 243 NDF; 146 ADF; 24 ADL; 12 Ca; 5 P; 2 Na g/kg of feed and 191 mg Zn/kg DM). Feeds were fed in ratio 1:1 *ad libitum*. The experimental group (34 does) received lactation feed with added 500mg Zn in chelat form; analytic value was 670.97 Zn/kg of feed. Combining two feeds (standard and lactation) the Zn supply in control group was 242 mg and in experimental group 482mg Zn/kg of consumed diet.

In comparison with control group (C) more pronounced loss of doe's weight from 10th to 31st day of lactation was observed in Zn-group (Zn: -163, C: -62g of live weight). In contrast, litter weight gain from 10th to 31st day of lactation was higher in Zn group by 4.67% (Zn: 4103, C: 3920g).

To eliminate the influence of litter size on litter weight gain a covariate analysis was used (linear regression on litter size). Differences in feed intake between groups were minimal (Zn: 9904g, C: 9791g in entire trial period). Mortality in Zn-group

was lower by 0.54%. None of the differences were statistically significant.

Reduction of N-excretion of growing rabbits using phase feeding.

L MAERTENS, F. LUZI. (Belgium-Italy)

Mineral pollution originating from animal production, especially from nitrogen and phosphorus has become a major problem in several European countries having a high density of animal production. In a former experiment, we have shown that the reduction of N-excretion is directly related to the dietary protein quality and quantity. Moreover, the response in weight gain and feed intake to dietary protein dilution was age dependent. Further efforts to reduce the N-excretion were performed using phase feeding.

Using the dilution technique, 3 iso-energetic starter diets (S1-S3) and 4 finishing diets (F1-F4) were prepared with linear decreasing protein content (between 16.3 and 14.9% CP and 15.4 and 13.3% CP, respectively for S and F diets). Lysine, methionine + cystine and threonine were above the assumed requirements in all diets. Six different combinations of starter (0-3 weeks) and finishing diets (4-6 weeks), and a least cost diet containing 18.3% CP as control, were fed during the 6 week fattening trial. In total 252 weaned rabbits (29 days old) caged per 3 were used for the trial. The comparative slaughter technique was used to determine nitrogen accretion and retention.

During the starter period, weanlings fed the S1 diet showed significant ($P < 0.01$) higher weight gain than controls and the S2 and S3 treatment. During the second phase, controls had higher ($P < 0.01$) gain than on the different F-diets. Between the F-diets, only a tendency to decreased weight gain was observed with decreasing CP content. For the overall period, rabbits fed during the first phase a diet of 16.3% CP followed by a finisher containing 15.4 or 14.7% CP showed equal gain as controls. However, their N-excretion decreased by 26 and 29%, respectively. On the 4 other phase feeding schemes, a decrease in weight gain between 3.2 and 6.2% was observed but the corresponding decrease in N-excretion was between 26.8 and 45.0%.

Effect of probiotics on fattening and slaughter performance of rabbits.

P. BIELANSKI, ST. NIEDZWIADK; J. ZAJAC;
D. KOWALSKA (Poland)

The effects of different probiotics: Probios, Bb, Lacto-Sacc, Yea-Sacc and SK1 on fattening and performance traits in New Zealand White rabbits were studied.

The use of probiotic Bb decreased rabbit mortality from 7.84% at weaning to 1.56% at slaughter. Feed conversion ratio was also lowered by about 0,1kg. Compared to others, bacterial, yeast and bacterial-yeast probiotics, the best results were obtained using preparation Bb.

The second probiotic, SK1, was shown to be as highly efficient as other preparations available on the Polish market, but it was less effective than preparation Bb in respect of production results