

THESES OF DOCTORAL (PhD) DISSERTATION

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EFFECT OF DIFFERENT REARING METHODS ON THE BEHAVIOUR AND PRODUCTION OF GROWING RABBITS

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1. Introduction

In animal husbandry the requirement of efficient and safe production taking animal welfare and environmental viewpoints into account is gaining importance world-wide. During the last years also the consumers' demands changed substantially and the meat originated from animals kept in (semi)natural conditions is favoured. Therefore, experiments also in rabbit breeding focused on developing alternative housing systems, which can increase the animal comfort and welfare during the rearing period. From the animal welfare viewpoint the most often mentioned problems are the too high stocking density and the restriction of locomotion. According to the animal welfare aspects in rabbit breeding the application of deep litter and rearing in relatively large groups is currently advocated.

In several former experiments in rabbit breeding different types of alternative rearing methods were already tested for improving the comfort and welfare of the animals. These experiments provided some clear tendencies, but many unanswered questions are still remained. There are still no official EU directives (only recommendations in some countries) available for rabbit housing.

The objective of this study is researching full scale some alternative housing systems and behaviour, production and slaughter traits, and meat quality of rabbits in the same time, according to the requirements of animal welfare and consumers' demands in rabbit breeding.

Achieving the above mentioned objectives, the following specific aims were defined:

1. Analysis the effect of deep litter - placing in different stage of growing - for the rabbits' behaviour, and as well as the conformation of production, slaughter traits and meat quality, at different stocking density.
2. Analysis the behaviour of growing rabbits reared in pens of different sizes, wire net and deep litter-floor at different stocking density, as well as the conformation of production, slaughter traits and meat quality.
3. Analysis the behaviour of growing rabbits reared at different stocking density in wire net and combined (half straw and half wire net) floor, and as well as the conformation of production, slaughter traits and meat quality.

2. Material and methods

Experiments were carried out at the Faculty of Animal Science, Kaposvár University (between 2005 and 2007), using Pannon White rabbits (n=716) of both sexes. Animals were kept in a closed building at 16-17 °C room temperature using a lighting regime of 16L/8D. Rabbits were kept in conventional cages, and in open top pens. The experiments took place between the ages of 5 to 11 weeks. Growing rabbits were fed with medicated pellet until the age of 9 weeks (14.5% crude protein, 17.5% crude fibre, 2.0% ether extract, 10.3 MJ DE/kg, 50 000 mg/kg Tilmikozin and 0.025% Pulmotil 200) and with a non-medicated pellet (16.0% crude protein, 16.0% crude fibre, 3.0% ether extract, and 10.6 MJ DE/kg) thereafter *ad libitum*. Drinking water was available continuously from nipple-drinkers.

2.1. SETTING OF EXPERIMENTS

2.1.1. FIRST EXPERIMENT

In the first experiment 240 Pannon white growing rabbits were used, in two repetitions. The rabbits were housed in twelve 80 cm high open top pens, each having a basic area of 50×170 cm. Every pen was equipped with a 40 cm long feeder and with two nipple drinkers. The feeder was taken at one end of the pen and the nipple drinkers were taken at the opposite end of the pen. During the rearing period three different stocking densities were used (7, 10 and 13 rabbits per pen, i.e. 8, 12 and 16 rabbits per m²). The 4-4 pens of the same stocking densities differed only in the type of floor:

- wire net during the whole experiment,
- wire net until the age of 7 weeks, then deep litter,
- wire net until the age of 9 weeks, then deep litter,
- deep litter during the whole experiment.

2.1.2. SECOND EXPERIMENT

In the second experiment 312 Pannon white growing rabbits were used, in two repetitions. In the second experiment – according to the pen size, floor type and stocking density – the following experimental groups were formed:

large pen (100x170 cm), wire net, 16 rabbits/m² stocking density (n=26/repetition)

large pen (100x170 cm), wire net, 12 rabbits/m² stocking density (n=20/repetition)

small pen (50x170 cm), wire net, 16 rabbits/m² stocking density (n=13/repetition)

small pen (50x170 cm), wire net, 12 rabbits/m² stocking density (n=10/repetition)

small pen (50x170 cm), deep litter, 8 rabbits/m² stocking density (n=7/repetition)

small pen (50x170 cm), deep litter, 12 rabbits/m² stocking density (n=10/repetition)

large pen (100x170 cm), deep litter, 8 rabbits/m² stocking density (n=14/repetition)

large pen (100x170 cm), deep litter, 12 rabbits/m² stocking density (n=20/repetition)

Thirty-six rabbits/repetition were placed into conventional cages (30x33 cm, wire net floor, 2 rabbits/cage, 16 rabbits/m²) as control.

2.1.3. THIRD EXPERIMENT

In the third experiment 124 Pannon white growing rabbits were used, in two repetitions. Rabbits were placed into 12 pens (50x170 cm basic area), which differed only in the type of floor. Six pens had a wire net, six pens a combined floor (half of the floor wire net and half of the floor straw litter). In the pens with combined floor rabbits had a free access to the different types of floor (wire net and straw litter). On both floor types (wire net and combined) three stocking densities (8, 12 and 16 rabbits/m²) were applied. Thirty-six rabbits were placed into conventional cages (2 rabbits/cage) as control group.

2.2. BEHAVIOUR ANALYSIS

A 24 hour video recording was performed once a week using infrared cameras on the same day of every week during the 6 week long experiment. Using the 24 hour video recording every 10th minute was evaluated. The activities performed at these times were recorded and their frequencies and percentages were calculated for 24 hours. The following activities were analyzed: eating, drinking, locomotion, rest, comfort, social and agonistic behaviours, stereotypes and the frequency of deep litter consumption (for rabbits housed in deep litter).

2.3. MEASUREMENT OF PRODUCTION PARAMETERS

The body weight and the feed consumption of the rabbits were recorded weekly. The body weight was measured individually, while the feed consumption per pen or per cage, respectively. Based on the measured data the daily weight gain and the feed conversion ratio were calculated.

2.4. SLAUGHTER AND DISSECTION

At the end of the experiment – at 11 weeks of age – all of the animals were slaughtered. Prior to the slaughter no fasting was applied. Immediately after the slaughter the hot carcasses – including the head, heart, lungs, liver, kidneys and fat – were measured and then chilled at a temperature of 4 °C for 24 hours. Thereafter the chilled carcasses were also measured and the heart, lungs, kidneys, scapular and perirenal fat were removed. The carcasses were then dissected according to the WRSA proposal (Blasco and Ouhayoun, 1996). The weight of the different organs and body parts was determined and their ratio to the chilled carcass weight was also calculated.

2.5. MEAT QUALITY ANALYSIS

The meat quality was studied on *m. longissimus dorsi* (MLD). We measured pH and colour of samples, the dry matter, protein, fat and ash content were determined. For pH measurement Testo 205 pH meter was used. The colour was determined by Chromameter Minolta CR-300. Dry matter, protein, fat and ash content of samples were determined according to Hungarian Standard specifications (dry matter MSZ ISO 1442, raw protein: MSZ EN ISO 5983-1:2005, raw fat: MSZ 6369-15:1982, raw ash: MSZ ISO 5984:1992).

3. Results and discussion

3.1. EXAMINATION OF GROWING RABBITS PLACING ONTO DEEP LITTER IN DIFFERENT TIME

3.1.1. BEHAVIOURAL PATTERNS

The frequency of eating was affected significantly by the floor type and age. The observed frequency of eating was significantly higher for rabbits kept on wire net floors. Similarly, the eating frequency decreased continuously with advancing age. After placing deep litter on the wire net floor the frequency of eating decreased significantly.

Frequency of locomotion was not affected significantly by the floor type or stocking density. The highest activity of the rabbits could be observed during the first week of the experiment.

Frequency of resting was significantly affected by stocking density and floor type and age. Contrary to our expectations a significantly higher frequency of resting was observed on the wire net than on the presumably more comfortable deep litter. Increasing stocking density resulted in a higher frequency of resting. Analysing the affect of age was observed that the frequency of this behaviour pattern had been increased by the end of the experiment.

A significantly higher frequency of comfort behaviours was also found on wire net than on deep litter. The highest frequency of comfort behaviours was found using the highest stocking density.

Social behaviours were occasionally affected by stocking density and age but no clear tendencies could be detected.

The occurrence of stereotypic behaviour was relatively high during the first two weeks of the experiment after which it decreased and during the last two weeks of the experiment, it was not observed in either group.

3.1.2. PRODUCTION

Examining the feed consumption I diagnosed that rabbits reared on wire net were eating more pellet during the whole time of experiment, than those who were reared on deep litter for shorter-longer period. The observed differences could not be proven statistically, among the experimental groups ($P>0.05$).

For the group which was staying on the wire net floor their weight gain exceeded that of the of deep litter reared rabbits. It was observed that the live weight was the highest at wire net reared rabbits by the 11 week age.

At rabbits which were raised all through on wire net floor and on deep litter there were more than 100 g difference in their 11 week age weight.

According to feed conversion ratio the optimum rate was observed at all through wire net reared group. The differences observed between experimental groups, however, in this case could not be verified statistically ($P>0.05$).

3.1.3. SLAUGHTER

The length of rearing on deep litter was not significantly affected neither the slaughter weight, nor the certain organs or body parts and the cold carcass ratio.

3.1.4. MEAT QUALITY

Examining the pH of the MLD it was observed that the time of placing onto deep litter did not significantly influence it.

In dry matter, protein and fat content of meat samples, significant effect was experienced dependent on the period of rearing on deep litter. The three meat parameters at those rabbits which were raised in deep litter from 5 week age and 7 week age, was significantly behind, than at those rabbits which were raiser in deep litter from 9 week age or in wire net during the whole experiment.

Among the parameters of meat colour (brightness, yellowness, redness) only at brightness could be shown significant effect of duration of rearing on deep litter. But in this case, no clear trend could be observed.

The stocking density among the studied parameters, affected significantly only the pH of the MLD and its yellowness. The pH at 8 rabbits/m², and the yellowness at 16 rabbits/m² stocking density showed the lowest rate.

3.2. ANALYSIS OF GROWING RABBITS RAISED IN DIFFERENT SIZE PENS, ON DIFFERENT FLOOR AND AT DIFFERENT STOCKING DENSITY

3.2.1. BEHAVIOURAL PATTERNS

Analysing the eating behaviour it was concluded that the rabbits housed in conventional fattening cages performed this behaviour pattern more frequently than the rabbits kept in pens. However, the higher frequency of the eating behaviour of the control animals was statistically not proven at $P < 0.05$ level.

The occurrence of the locomotory behaviours was more frequent for rabbits housed in pens than for the control animals. However, compared to the rabbits housed in conventional fattening cages significantly ($P < 0.05$) higher frequency of the locomotory behaviours could only be detected in that experimental group, where rabbits were reared in a large pen, using a stocking density of 8 rabbits/m² and applying deep litter. The reason of this phenomenon can probably be explained by the fact that aggressive animals were found only in this pen.

The resting frequency did not differ significantly among the experimental and control groups. However, both in the small and large pens it was observed – although it was not statistically proven – that the resting behaviour was less frequent on the deep litter than on the wire net floor.

Concerning comfort behaviour it is worth mentioning that the rabbits in the control group showed similar frequency to that of rabbits housed in pens

on deep litter. The comfort behaviour of the rabbits housed in pens on wire net greatly exceeded that of the rabbits in the control group.

The social behaviour could be observed more frequently for the rabbits housed in pens, but significant differences were only found for the groups reared in deep litter.

Stereotype behaviour was not observed in the small pens and it was only occasionally recorded in the large pens. On the contrary, in the control group the frequency of this behaviour form was substantial.

3.2.2. PRODUCTION

Significant differences were not found between the feed consumption of the experimental and control animals. The higher daily gain was found control group rabbits.

3.2.3. SLAUGHTER

In the examined slaughter parameters no significant differences were found between the experimental and control animals.

3.2.4. MEAT QUALITY

For wire net raised rabbits at 12 rabbits/m² stocking rate the dry matter content of MLD were significantly higher than the control animals. In the colour of MLD significant differences were rarely found between pen raised and control rabbits. To consider the yellowness consistently higher values were measured at pen raised rabbits.

3.3. ANALYSIS OF WIRE NET FLOOR AND COMBINED FLOOR REARED GROWING RABBITS

3.3.1. BEHAVIOURAL PATTERNS

The frequency of eating (consumption of the pellet) was significantly lower on the combined floor, than on the wire net floor, which could be explained by the straw consumption of the rabbits observed on this floor type.

It was interesting to see that the frequency of resting and comfort behaviours were significantly higher on the wire net floor than on the combined floor.

The favourable effect of the combined floor was observed mostly in the social and stereotype behaviours. It was observed that the litter placing increased frequency of social behaviour. The frequency of the social behaviour was more than two times higher, on the combined floor than on the wire net floor.

In this experiment the stereotype behaviour was observed only at wire net reared rabbits. This behaviour pattern could rarely (<0,5%) be observed at combined floor reared rabbit.

3.3.2. PRODUCTION

Examining the feed intake was found that the traditional consumption of growing rabbits reared in cages at all times during the experiment exceeded the grid niches, or animals reared in the combined floor.

The first three weeks of the experiment – 5 and 8 weeks of age – the combined floor reared rabbits' average daily gain is about 10% below than that of the wire net floor fattened rabbits.

In the combined floor raised rabbits, their lower weight gain during the initial 11 weeks of age live weight of rabbits was still detectable. The stocking density had no significant effect on weight gain in rabbits.

3.3.3. SLAUGHTER

In spite of the slaughter weight the dressing out percentage (ratio of warm carcass to the live weight) was higher in animals reared on the combined floor. The type of floor had a significant effect also on the ratio of the hind part to the chilled carcass. The between group difference was significant at $P < 0.01$ level. The ratio of MLD to the chilled carcass differed also significantly ($P < 0.05$) between the two pen-raised groups.

From the edible organs the ratio of the heart and the lungs to the chilled carcass was very similar for the rabbits reared on the two types of floor, while the ratio of the liver and kidneys was higher in rabbits kept on the wire net floor.

The main fat depot of the rabbits (perirenal fat) was significantly ($P < 0.01$) higher for those kept on the wire net floor than on the combined floor. In the case of the scapular fat no between group differences were observed.

The stocking density showed a significant effect only in the case of the fore part and in the case of the perirenal fat. Rabbits reared at the highest stocking density (16 rabbits/m²) had the highest ratio of the fore part, and these animals accumulated the highest amount of fat in their abdominal region.

3.3.4. MEAT QUALITY

It was observed, that floor type had no effect but the stoking density had significant effect on pH. For the rabbits reared in the highest stocking density their MLD were measured the lowest pH, which differed significantly from 12 rabbits/m² stocking density reared rabbits' results.

Both the floor type, both the stocking density significantly affected the dry matter content of MLD. Considering the floor type on the wire net floor and the stocking density at 16 rabbits/m² reared rabbits were measured the highest values.

Only the stocking density affected significantly the protein content of MLD. The highest values could be observed at the highest stocking density reared rabbits.

For the fat and ash content there were no tendency and significant difference between the groups.

4. Conclusions and suggestions

Based on the results of the conducted experiments the following major conclusions can be made:

- Instead of the conventional cage, rearing the rabbits in pens having more floor space decreases the growing rabbits' daily weight gain and feed conversion ratio, and increases the length of growing period achieving the same slaughter weight.
- According to animal welfare, it is important, that rearing in pens decreases the frequency of stereotype behaviours.
- Placing rabbits into deep litter during rearing in pens decreases the frequency of eating and food consumption, which causes the reduction of weight gain and lengthens the growing period.
- At deep litter raised rabbits have to be also considered with litter eating, which means animal health risks beside weight gain decreasing and longer growing period.
- Feeding medicated pellet till 9 week age - and the refreshing of deep litter regularly - seems that the rearing on deep litter – considering illness and mortality – is not disadvantageous compared to wire net rearing.
- At the final stage of growing – at changing to non-medicated pellet – at deep litter reared rabbits increasing litter consumption can be expected.
- From animal welfare point of view it is favourable, that raising on deep litter increases the frequency of social behaviour.
- The time of placing into deep litter affects the rabbits' daily weight gain.
- Rearing in pens – either wire net floor or deep litter – does not affect the slaughter traits of the rabbits.

- Rearing on deep litter decreases significantly the dry matter content of MLD.
- Decreasing the stocking density from the used 16 rabbits/m² to 8, and 12 rabbits/m² density, has no positive effect neither on the behaviour of rabbits, nor on the production.

Based on the results of these experiments – taking the expectations of animal welfare and economic production into account – rearing in pens at 16 rabbits/m² stocking density can be suggested, on wire net floor till 9 weeks of age and on deep litter thereafter. Placing animals on deep litter at 9 weeks of age can decrease the negative effect of changing the medicated pellet to the non-medicated, while – from the animal welfare's viewpoint – it increases the frequency of the social behaviour and decreases the frequency of the stereotype behavioural forms. This method of rearing decreases the slaughter weight only by 30-40 g and it has no negative effect on the slaughter value of the rabbits. However, in case of this type of rearing, the cost of straw and the wage of littering must be calculated, therefore it could be profitable only in that case, if extra costs are built into the price of the rabbits.

5. New scientific results

1. Against the conventional cages, group rearing of rabbits in pens decreases the frequency of stereotype behaviour.
2. Placing growing rabbits into deep litter increases the frequency of required social behaviour, but – due to the straw consumption – decreases the rabbits' feed consumption and daily weight gain.
3. Increasing the duration of deep litter raising decreases the slaughter weight of rabbits.
4. Rearing in pens – either wire net floor or deep litter – does not affect the slaughter traits of rabbits, but rearing on deep litter decreases significantly the dry matter content of MLD.
5. Deep litter raising or combined floor raising during the whole period of growing has also more disadvantage, therefore these rearing methods can not be recommended for the intensive production.
6. According to the requirements of economical production, animal welfare and consumers it could be a compromised solution that the rabbits would be placed into wire net floor after weaning and in the final period of growing they would be placed into deep litter.

6. Scientific papers and lectures on the subject of the dissertation

6.1. SCIENTIFIC PAPERS IN FOREIGN LANGUAGES

- 1. JEKKEL, G. – MILISITS, G. – NAGY, I. (2007):** Effects of floor type and stocking density on the behaviour modes of growing rabbits. *Agriculture*, 13 (1), 150-154
- 2. JEKKEL, G. – MILISITS, G. – BÁZÁR, GY. – LOCSMÁNDI, L. – NAGY, I. (2008):** Effects of stocking density, cage and floor type on the meat quality of growing rabbits. *Acta Agriculturae Slovenica, Supplement, Number 2*, 59-64
- 3. JEKKEL, G. – MILISITS, G. (2009):** Comparison of the behaviour of growing rabbits reared on wire net or combined floor at different stocking densities. *Italian Journal of Animal Science, Vol. 8. Supplement 3*, 202-204
- 4. JEKKEL, G. – MILISITS, G.- NAGY, I. (2010):** Effect of alternative rearing methods on the behaviour and on the production and slaughter traits of growing rabbits. *Archiv für Tierzucht, (In Press.)*

6.2. SCIENTIFIC PAPERS IN HUNGARIAN

- 1. JEKKEL, G. – MILISITS, G. – BIRÓNÉ NÉMETH, E. (2008):** A nevelés különböző szakaszában mélyalomra helyezett növendéknyulak viselkedésének vizsgálata. *Animal welfare, etológia és tartástechnológia*, 4 (3), 164-180
- 2. JEKKEL, G. – MILISITS, G. – BIRÓNÉ NÉMETH, E. (2010):** Eltérő telepítési sűrűséggel mélyalomra helyezett növendéknyulak termelési és vágási tulajdonságainak vizsgálata. *Állattenyésztés és Takarmányozás, (In Press.)*

6.3. FULL CONFERENCE PAPERS IN FOREIGN-LANGUAGE IN PROCEEDINGS

- 1. JEKKEL G. – MILISITS G. – BIRÓNÉ NÉMETH E. – RADNAI I. – MATICS ZS. – PRINCZ Z. – OROVA Z. – GERENCSÉR ZS. – SZENDRŐ ZS. (2006):** Eltérő padozat és telepítési sűrűség hatása a növendéknyulak vágási tulajdonságaira. *18. Nyúltenyésztési Tudományos Nap*, Kaposvár, 2006. május 24., 189-194
- 2. JEKKEL G. – MILISITS G. – MATICS ZS. – PRINCZ Z. – GERENCSÉR ZS. – OROVA Z. – SZENDRŐ ZS. (2006):** A padozat és a telepítési sűrűség hatása a növendéknyulak néhány viselkedésformájának alakulására. *XXXI. Óvári Tudományos Nap*, Mosonmagyaróvár, 2006. október 5., CD-ROM

3. **DALLE ZOTTE, A. – MASOERO, G. – SALA, G. – JEKKEK, G. – MILISITS, G. – SZENDRŐ, ZS. (2007):** Effects of housing system on the meat quality of fattening rabbits by NIRS using ethanol or freeze-dried specimens. *53rd International Congress of Meat Science and Technology*, Peking (Kína), 2007. augusztus 5-10., 339-340
4. **JEKKEK G. – MILISITS G. – LOCSMÁNDI L. – ANDRÁSSYÉ BAKA G. – SZABÓ A. – BÁZÁR GY. - BIRÓNÉ NÉMETH E. (2007):** Eltérő ketrecméret, padozat és telepítési sűrűség hatása a növendéknyulak néhány húsminőségi tulajdonságára. *XLIX. Georgikon Napok*, Keszthely, 2007. szeptember 20-21., CD-ROM
5. **JEKKEK G. – MILISITS G. – METZGER SZ. – OSTHOFF L. – BIRÓNÉ NÉMETH E. (2007):** Eltérő ketrecméret, padozat és telepítési sűrűség hatása a növendéknyulak termelési tulajdonságaira. *XLIX. Georgikon Napok*, Keszthely, 2007. szeptember 20-21., CD-ROM
6. **JEKKEK G. – MILISITS G. – BÁZÁR GY. – LOCSMÁNDI L. (2008):** A ketrecméret, a padozat és a telepítési sűrűség hatása a növendéknyulak húsminőségére. „*Multifunkcionális mezőgazdaság*” nemzetközi konferencia, Hódmezővásárhely, 2008. április 24., CD-ROM
7. **JEKKEK, G. – MILISITS, G. – NAGY, I. – BIRÓ-NÉMETH, E. (2008):** Analysis of the behaviour of growing rabbits housed in deep litter at different stages of rearing. *9th World Rabbit Congress*, Verona (Olaszország), 2008. június 10-13., 1189-1193

8. **JEKKEL, G. – MILISITS, G. - BIRÓ-NÉMETH, E. – RADNAI, I. – MATICS, ZS. – PRINCZ, Z. – GERENCSÉR, ZS. (2008):** Comparison of the slaughter characteristics of growing rabbits reared on wire net or combined (wire net / straw) floor. *9th World Rabbit Congress*, Verona (Olaszország), 2008. június 10-13., 1365-1369

9. **DALLE ZOTTE, A. – MASOERO, G. – BRUGIAPAGLIA, A. – CONTIERO, B. – JEKKEL, G. – MILISITS, G. (2008):** Sensory and rheological evaluation of meat from rabbits reared at different floor type and stocking density. *54th International Congress on Meat Science & Technology*, Fokváros (Dél-Afrikai Köztársaság), 2008. augusztus 10-15.,

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2. **JEKKEL, G. – MILISITS, G. (2008):** Effect of substitution of wire net floor with straw litter at different stages of the rearing period on the production and slaughter traits of growing rabbits. *Book of Abstracts of the 4th International Workshop on the Assessment of Animal Welfare at Farm and Group Level*, Gent (Belgium), 2008. szeptember 10-13., 133

3. **JEKKEL, G. – MILISITS, G. (2008):** Effect of different alternative rearing methods on the production traits and slaughter characteristics of growing rabbits. *Book of Abstracts of the 4th International Workshop on the Assessment of Animal Welfare at Farm and Group Level*, Gent (Belgium), 2008. szeptember 10-13., 134

7. Publications in the topic outside the dissertation

7.1. SPECIALIST BOOK

- 1. JEKKEK G. (2008):** 100 kérdés 100 felelet, amit a törpenyúltartásról tudni kell. *Agroinform Kiadó*, Budapest
- 2. JEKKEK G. (2009):** 100 kérdés 100 felelet, amit a macskáról tudni kell. *Agroinform Kiadó*, Budapest

7.2. SCIENTIFIC PAPERS IN FOREIGN LANGUAGES

- 1. MILISITS, G. – KOVÁCS, E. – LOCSMÁNDI, L. – SZABÓ, A. – ANDRÁSSY-BAKA, G. – JEKKEK, G. – ROMVÁRI, R. (2007):** Applicability of the TOBEC method in selection of hen's eggs based on their composition. *Agriculture*, 13 (1), 209-212
- 2. BÁZÁR GY. – PRINCZ Z. – JEKKEK G. – LOCSMÁNDI L. – ANDRÁSSY-BAKA G. – KÖVÉR GY. – SZENDRŐ ZS. – ROMVÁRI R. (2007):** NIRS prediction for protein and intramuscular fat content of rabbit hind leg meat. *Agriculture*, 13 (1), 155-158
- 3. MILISITS, G. – PŐCZE, O. – UJVÁRI, J. – KOVÁCS, E. – JEKKEK, G. – SÜTŐ, Z. (2009):** Comparison of the slaughter characteristics of meat-type chicks hatched from eggs with different composition. *Italian Journal of Animal Science*, Vol. 8. Supplement 3, 231-233

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- 1. GERENCSÉR ZS. – THEAU-CLEMENT, M. – RADNAI I. – BIRÓNÉ NÉMETH E. – MATICS ZS. – PRINCZ Z. – OROVA Z. – JEKKEK G. – SZENDRŐ ZS. (2006):** Termékenyítés előtti megnövelt megvilágítás hatása az anyanyulak termelésére és szoptatási viselkedésére. *13. Szaporodásbiológiai Találkozó és Nemzetközi Szimpózium.*

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1. **MILISITS, G. – PÓCZE, O. – UJVÁRI, J. – KOVÁCS, E. – JEKKEK, G. – SÜTŐ, Z. (2009):** Effect of hen's eggs composition on the slaughter characteristics of hatched chicks. *60th Annual Meeting of the European Association for Animal Production*, Barcelona (Spanyolország), 2009. augusztus 24-27., 167

7.5. EDUCATIONAL PUBLICATIONS

1. **JEKKEK G. (2004):** Szaporodással kapcsolatos viselkedés. *Kistermelők Lapja*, 48 (3), 24
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