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EXPERIMENTAL *PER OS* APPLICATION OF PROBIOTICS LACTIFERM IN PULLETS AND LAYING HENS

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The experimental continual application of probiotics Lactiferm (MEDIPHARM CZECHOSLOVAKIA) was verified in practical breeding conditions in pullets (n = 155 538) and laying hens (n = 127 043) Shaver Starcross 288. Differences in average feed mixtures consumption per day between experimental and control pullets amounted to 2,17 g in favour of the experimental groups. Differences in feed consumption per 1 kg weight gain of experimental and control pullets amounted to 709 g in favour of the experimental pullets. The total difference in feed consumption per one egg was, in all three control groups of laying hens, in average about 12.60 g higher in contrast with the three experimental groups in laying hens. A theoretical daily saving in commercial feed mixtures at SZP Markovice amount 226,8 kg. During annual production of 55 700 000 eggs at SZP Markovice, the saving in commercial feed mixtures amount to 701,82 tons or 31 581 900 Kč.

Gallus domesticus; pullets; laying hens; nutrition; probiotics; Lactiferm

INTRODUCTION

The ingestion of bacteria and especially Lactobacilli was, in 1907, proposed by the Russian Scientist, Elie Metchnikoff at the Pasteur Institute, Paris, France, in order to reduce putrefaction and disorders of intestinal origin in humans and prolong the life expectancy (Conway et al., 1987; Humbert, 1988).

The word probiotics was first used by Lilly (Fuller, 1986; Tournut, 1989). The term „probiotics" is of Greek origin and means „for life" in contrast with antibiotics, which mean „against life". Any use in animal health and production of microbes and their physiological or structural products, rather than antimicrobial metabolites, is a probiotic use, whether they are intended for nutritional, therapeutical or „antistress" use. Probiotic products (Mičan, 1990; Koudela et al., 1992) are preparations, of natural or

cultured microbial origin, containing one or more of the following: 1) living organisms, e.g. yeast, enterococci, similar organisms, 2) killed extracts, e.g. enzymes, structural cell components, 3) processed natural material, e.g. ruminal fluid.

There is a great deal of hypotheses to explain the mode of action of probiotics (R a d a , 1992). Though, it is little known about the way probiotics react inside the gastro-intestinal tract (GIT), some assumptions were at least experimentally proved (F u l l e r , 1992). According to these researchers, the effect of probiotics could be explained as follows:

1) Neutralization of toxins
2) Antagonism against a mono specific group of bacteria
3) Influence of microbial metabolism
4) Stimulation of immunity.

In a wide range of Czech as well as foreign literature, we did not find any reliable data on the influence of experimental or practical use of probiotics neither on pullets rearing nor egg laying performances.

The primary aim of this research was to remove thus far remaining lags in the understanding of the influence of experimental application of probiotics Lactiferm on pullets and layers.

During original experimental feeding studies with Czechoslovak probiotics Lactiferm, particular attention is paid to the following aspects:

1 – reactivation of experimetal pullets and layers during *per os* application of tested probiotics
2 – stability of probiotics in commercial feed mixtures
3 – production characteristics of pullets and layers
4 – economic contribution of the application of probiotics.

MATERIAL AND METHODS

Experiments took place at the Common Farm for Eggs Production Markovice – which is the part of the Cooperative Agricultural Company in the Kutná Hora district .

Zootechnical and zoohygienic conditions are in these production units very adequate. The health standard of chicks and layers is very high and is regularly checked by a team of specialists from the Veterinary Centre from Kutná Hora. Halls for chickens rearing are spaciously separated from those housing layers. There are in total 15 halls for chicken rearing.

In 1978 the reconstruction of one decked rearing cage, flat deck, into three four-decked-rearing cages, type L 133 and L 134 from the former Democratic

Republic of Germany was completed. At the time we carried out our experiment, the capacity of individual halls for layers was 20 000 birds.

One day-old sexed chicks Shaver Starcross 288 were donated by SPLP BROODER – NITRA. Individual supplies of chicks were accepted according to the Czechoslovak standard 46 6410, and were kept in sanitized halls. The disinfection effect was microbiologically verified and approved by the State Veterinary Institute at Český Brod. On day 10, 7, 13, 14, and 16th July 1990, were received in total 155 538 day-old chicks. Chicks and pullets were fed commercial feed mixture K-1, K-2 and K-Z, produced by ZZN Kutná Hora, feed mixers Dubina, according to the standard composition. Drinking water was drawn from wells within the area of the poultry farm. Feed was given *ad libitum* and water was always available. Probiotics Lactiferm was supplied by the Czechoslovak producers MEDIPHARM CS HUSTOPEČE, near Brno. Lactiferm L-50 (premix) with a concentration of 5 x 10^9 germs *Enterococcus faecium* M-74 per preparation was added to the feed mixtures at the dose of 30 g/t. Probiotics was, before the use in commercial mixtures, added to biofactors complements. For the whole rearing period, Lactiferm was fed to chickens in halls I and IV, those in halls II and III served as control groups (C1 and C2). Layers were divided into experimental and control groups (C1 and C2), respectively. The experimental group (E1) included layers, to which Lactiferm was experimentally fed for the whole period of rearing and egg laying. Experimental group E2 of layers received Lactiferm during the rearing period only, while the experimental group E3 of layers was fed on Lactiferm only during the egg laying period.

Experiments were organized into two basic phases, and that during rearing period (beginning 10th–16th June 1990, end in the week from 30th of October 1990) and the laying phase from 6th November 1990 to the end of the laying phase in September 1991.

The results obtained were evaluated according to regular variational method of statistics and were determined by the basic characteristics of mathematical selective sampling.

RESULTS AND DISCUSSION

From 10th through to 15th June 1990, sexed chicks were received and housed in sanitized halls. Individual supplies were conducted according to the Czechoslovak standard (ČSN) 46 6416. According to the harmonogramme applied in the Czech Republic, starting from the first day of life, chicks have to receive an immunization treatment against Marek's disease,

infectious bronchitis and Newcastle disease. Unpleasing reality was shown by the big variations in the live weight (in g) of supplied chicks:

Date	Minimum	Maximum
10th June 1989	28.5	41.0
13th June 1989	27.5	42.5
14th June 1989	26.0	42.0
15th June 1989	29.0	45.0

Experimental chickens were fed tested probiotics Lactiferm, which was supplemented to commercial feed mixtures according to the dose recommended by the producers, and that without any complements. No changes in the feed intake rhythm or diversities in the appetite of experimental chickens were recorded.

In the first ten days of chicks breeding, the control groups showed an insignificant low level of mortality compared with the experimental groups (C1 – 2.1%, E1 – 3.05%, C2 – 2.49%, E2 – 2.91%). The cause of losses through mortality was attributed to technopathy. Chicks with lower live weight were not capable of reaching the feeder. Some could not reach for water from the drinker pump. These feed and water deprivations are the cause of half of the total registered losses of mortality.

Applied Lactiferm could not influence the technological short fall, hence its effect, in the first ten days of post-incubatory life, could not be evaluated. The most important point here to be reported is the satisfactory degree at which probiotics Lactiferm was mixed with the feed mixtures. Regular check was conducted to determine both quantity and chrono- and thermostability of active germs *Enterococcus faecium* M-74 in experimental feed mixtures. For the whole period under study, the presence of *E. faecium* M-74 in feed mixtures was verified eight times. The first verification took place at the beginning of the experiment, the other remaining seven, each time when the control and experimental pullets and layers were killed.

Feed samples, used for verification, were taken from both silo and directly from feeder itself and that in every hall. Examination of feed samples, at the Institute of Microbiology, Czechoslovak Academy of Sciences, in Prague, carried out by Dr. J. Jírešová, CSc., at the enterococcal agar and PSE agar, has shown, in no case, a fall below $5 . 10^5$/g feed, in the density of *E. faecium*.

Obtained basic useful features should be compared with the guaranteed or already known indicators for rearing of layer hybrid Shaver Starcross 288 (Tab. I).

I. Guaranteed useful features of layer hybrid Shaver Starcross 288

Indicators		Technological process	
		Poultry Farm Xaverov 1978	SPLP – Nitra 1987
Live weight at 16th week of age	(g)	–	1 100–1 160
Live weight at the end of laying period	(g)	1 870	1 680–1 820
Losses through 140 days	(% of earlier capacity)	5.3	–
Average egg weight	(g)	60.5	60.5–62.5
Age of layers at 50% laying intensity	(days)	180	160–168
Maximum laying intensity at age	(weeks)	–	26–28
Feed consumption per egg	(g)	154	136–145
Cracked eggs (non standard eggs, eggs with low weight etc.)	(%)	10	10

Comparison of the two technological processes shows a high acquisition of useful parameters of layer hybrid Shaver Starcross 288 from the 1987 technology. Improvement is the result of target selection. At the time of stock clearing, the following live weight, gained during pullets rearing, was documented (Tab. II).

II. Layer pullets live weight at 16 weeks of age (g)

Group	n	$\bar{x}$	s	v%
C1	41 912	1 101	146	13
E1	28 808	1 143	129	12
C2	42 386	976	183	16
E2	42 432	1 167	109	9

It is necessary to notify that guaranteed live weight was, for both experimental groups, peculiar, partly then for the first control group of layer pullets. It was not possible to reach the guaranteed live weight in the second control group of layer pullets. This growth retardation will have been caused by the appearance of virus disease with haemorrhagic infiltrations into the subcutaneous part of the population, which had to be cured through application of antibiotics CHRONICIN Spofa.

Statistically insignificant variations in pullets live weight are also interesting in the sense that, the two experimental groups of pullets, which experimentally received a continual application of Lactiferm, were, by average, 117 g heavier than the two control groups of pullets. Live weight (g) of layers are shown in Tab. III.

III. Layers live weight (g)

Group	n	$\bar{x}$	s	v%
C1	19 383	1 580	135	9
E1	19 306	1 630	184	11
C2	25 644	1 610	225	14
E2	25 570	1 620	189	12
C3	17 655	1 690	237	14
E3	19 385	1 600	218	14

Obtained final live weight of experimental and control layers was at the lower limit of guaranteed values. It will be necessary to remind here that, the laying period was for organizational purposes shortened to 62 weeks of layer's life. Experimental layer pullets were about 10 g lighter on average than those of control groups.

Losses during rearing period have been reported only by the older technological process (5.3%). Mortality frequencies of pullets differed among younger and older pullets (Tab. IV). Percentage of mortality in control groups of pullets was slightly lower than in experimental groups. Only in case of

IV. Mortality frequencies among pullets (%)

Age (days)	Group						
	C1	E2	C2	E2	C1 + C2	E1 + E2	Total
1–7	2.28	2.87	1.78	2.75	2.00	2.81	2.37
1–10	2.71	3.05	2.49	2.91	2.60	2.98	2.77
1–112	6.56	7.49	5.88	6.92	6.22	7.20	6.71
Marek's disease as a cause of mortality							
1–112	18.87	19.81	20.58	18.22	19.72	19.01	19.37

Marek's disease a slight low mortality frequencies (19.01%) were recorded in experimental than in the control group of pullets (19.72%).

Average egg weight of layer hybrid Shaver Starcross 288 facillates according to technological process in the range of 60.5–62.5 g. Tab. V summarizes the egg weights of experimental and control groups of layers.

V. Average egg weight (g)

Group	$\bar{x}$	s	v%
C1	60.50	3.23	5
C2	60.35	3.17	5
C3	60.60	3.42	6
C	60.51	3.27	5
E1	61.27	2.86	5
E2	61.18	3.15	5
E3	60.73	2.24	4
E	61.06	2.75	5
C + E	60.78	3.01	5

Experimental application of probiotics Lactiferm has shown to be favourable. In contrast with the average egg weight from the control group of layers, eggs from experimental layers were heavier by 0.57 in average. The difference in the average of egg weight between worse control groups and better experimental groups reached 0.92 g and that between better experimental groups of layers reached 0.67 g, while the one between worse experimental and worse control groups amounted to 0.38 g. The difference in average egg weight between better control and worse experimental groups of layers was recorded to be 0.13 g.

Guaranteed level of 50% egg production is registered at 161–168 days of age (technological process SPLP – Nitra). In control group, this level is reached at the age between 163 and 170 days of layers' life (C1 – 170, C2 – 163, C3 – 165 days), in experimental groups of layers, needed period for attaining this level of laying was shortened by 11 days on average (E – 155 vs C – 166 days) in contrast with control layers. With the continual application of probiotics Lactiferm during the rearing period, 50% of egg production was reached at 154 days of age.

It is very interesting to notify that introductory colonization resistance brought about by the use of probiotics Lactiferm as feed supplement exclusively during the rearing period of pullets was linked with the 50% of eggs production in experimental layers E2 at the age of 155 days. The third experimental group, which received Lactiferm during the laying period only, 50% of eggs production took place at the age of 162 days. Application of probiotics accelerated the reaching of 50% of laying intensity. Reaching of maximal intensity is guaranteed by Nitra technological process at the age of 26–28 weeks. Application of probiotics accelerated the appearance of maximum egg production. In experimental group of layers E1, culminated eggs production starting from 181st day (end of the 25th week). Maximal production in experimental group of layers E2 was reported at 186th day of age (26 weeks), and the experimental group of layers E3 at the age of 197 days (28 weeks). Maximal eggs production in control groups of layers came slightly in contrast with experimental layers, that is to say 27th and 28th week (191, 195 and 199 days). The control group of layers did not reach 90% laying intensity, meanwhile experimental layers E1 reached that level at the age of 181 days, layers E2 at 189 days of age and layers E3 at 197 days of age.

Apart from acceleration of maximal laying intensity, the experimental groups of layers showed a high standard of production in contrast with control groups of layers, which were not fed on probiotics.

For profitable egg production, feed consumption for the production of one egg plays a primary role. Suppliers of layer hybrid guarantee, in technological process, feed consumption in the range of 136 and 145 g. The consumption of the complete feed mixtures for the production of one egg was in all three experimental groups lower than in control groups (Tab. VI).

VI. Feed mixtures consumption for the production of one egg (g)

Group	$\bar{x}$	s	$v\%$
C1	153.71	7.24	5
C2	146.92	6.17	4
C3	161.80	9.32	6
C	154.43	7.57	5
E1	139.63	5.45	4
E2	140.53	6.28	4
E3	144.47	8.51	6
E	141.54	6.74	5

Total difference in the production of one egg was higher by 13.99 g for the control layers in comparison with experimental ones.

This original finding is practically of the fundamental importance and presents here a clear economic saving or utility. Old technological process (Xaverov) tolerates the frequency of cracks, eggs with low weight and non standard eggs up to 10%. Summarized results on the frequency of cracks and non standard eggs are shown in Tab. VII.

VII. Frequency of cracks and non-standard eggs (%)

Group	Cracks	Non-standard eggs	Total
C1	5.2	3.1	8.3
C2	4.3	2.7	7.0
C3	4.4	2.5	6.9
C	4.6	2.7	7.4
E1	3.1	2.3	5.4
E2	3.2	2.1	5.3
E3	3.4	2.5	5.9
E	3.2	2.3	5.5

Occurrence of non-standard eggs did not, in control as well as in experimental groups, significantly differ. However, the experimental groups showed, interestingly, the lowest frequency of cracked eggs.

Experimental feeding of probiotics Lactiferm to layer pullets and layer has shown positive economic effects. Economic analysis can be best quantified at the level of feeding of both experimental and control pullets in the first 112 days of rearing. Tab. VIII summarizes basic feeding indicators.

The difference in the average feed consumption per feeding day between the two experimental and two control groups of pullets was 2.17 g. The saving in feed mixtures during the rearing period (112 days) from one layer pullet amounted to 243.04 g. From the two halls housing experimental layer pullets, 17.311 tons of feed were saved. Considering the cost of feed mixtures, in 1990, one comes up with a financial amount of 432 775 Kč. Excluding the cost of probiotics Lactiferm and related expenses for its inclusion into the feed mixtures (72 963 Kč), a total amount of 359 812 Kč was saved. With an increase in the cost of feed mixtures (1992), this potential financial saving could reach 778 995 Kč or 778 995 – 72 963 = 706 032 Kč, respectively.

VIII. Feeding of experimental and control layer pullets

Indicators	Group											
	C1			E1			C2			E2		
	$\bar{x}$	s	$v\%$	$\bar{x}$	s	$v\%$	$\bar{x}$	s	$v\%$	$\bar{x}$	s	$v\%$
FMC/D	50.96	5.63	11	49.55	5.11	10	48.67	5.98	12	47.74	4.99	10
FMC/kg	5 976	758	13	5 338	629	12	5 625	835	15	4 917	576	12
ALW	1 069	187	17	1 113	126	11	1 042	154	15	1 153	491	13

FMC/D = feed mixture consumption per feeding day (in g)
FMC/kg = feed mixtures consumption per kg growth (in g)
ALW = absolute live weight gain (in g)

The difference in feed consumption per live weight gain of experimental and control pullets reached, on average, 709 g, in the two experimental and both control groups of layers. Total feed saving from experimental pullets (71 240 birds) amounted to 50.509 t, or 1 116 707 Kč in 1990 and at present value (1992) of feed mixtures, 2 272 905 Kč.

The technological process (Nitra 1987) for layer pullets Shaver Starcross rearing, an orientation feed consumption figure of 4 837 g per live weight gain at the age of 112 days is documented. It is necessary to remind here that, in our experiment, this consumption was higher by 75 to 113 g, on average, according to individual groups.

Causes of increased feed consumption per 1 kg live weight gain can be possibly found both in technopathy in the early postincubation period, high variabilities in the original live weights and consequently, in the pertubation of active health. Fever disease, which took place following the appearance of virous infection and consequently the manifestation of haemorrhagical infiltrates into the subcutaneous area, will have significantly influenced the intermediary metabolism.

During pullets breeding, coccidiosis broke out because the suppliers of additive biofactors (BIOTIKA, s.p., Slovenská Ľupča) did not ensure enough effective quantity of coccidiostatics. The acute form of coccidiosis broke out in mid July, in the so-called critical period of the fifth week of post incubatory life.

Virous disease and coccidiosis were treated through the use of antibiotics and sulfonamids. However, the health disturbances and the generative processes interfered with the metabolic processes of the experimental and control pullets. It will be of great interest to notify here that in experimental group E2, feed consumption increased merely by 75 g on average. The difference

in feed consumption between the two control groups stood at 963.5 g and 290.5 g between the two experimental groups, respectively, in comparison with the orientation figure on feed consumption.

The increase in feed consumption was more than three times lower in experimental than in control groups. This situation could be attributed to the resistance colonization formed up mainly in the mucosa of the digestive tract of pullets continually fed on feed mixtures supplemented with probiotics Lactiferm. Experimental application of probiotics Lactiferm manifested itself favourably by lowering metabolism following disturbances in biochemistry and nutrition physiology during the outbreak of virous and parasitic diseases.

During an absolute evaluation of live weight gain between experimental and control groups of layer pullets, the average difference stood at 1 133 more or less 137 g (experimental pullets) and 1 055 more or less 156 g (control pullets), in total 77.5 g.

Experimental feeding of Lactiferm to pullets has also shown to stimulate the growth curve. Differences in the feed consumption for the production of one egg and that between the best experimental and the worst control group was, on average, 22.7 g. The one between the worst experimental and the worst control group of layers stood at 17.33 g. Differences between the all three controls and all three experimental groups of layers, which were fed on Lactiferm, were 12.60 g per egg. Daily egg production capacity at the Common Agricultural Farm for Eggs Production at Markovice stands at 180 000 birds. During saving of 12.6 g per egg, the daily saving of feed mixture could be, theoretically 226.8 kg during the application of Lactiferm. During an annual production of 55 700 000 eggs at Markovice, one assumes a saving of 701.82 tons of feed mixtures. Once calculated by the cost of feed mixture in 1990, a financial saving in the amount of 16 141 860 Kč is reported and at the present (1992), 31 581 900 Kč. It can be concluded that, with the experimental feeding of probiotics Lactiferm, be it to layer pullets or layers, a clean saving of feed mixtures is a reality.

Research work centered on the analysis of selected useful properties can be possibly generalized.

Important reality remains the ensurance of successful and acceptable incorporation of probiotics Lactiferm into feed mixtures and consequently, the effectiveness of studied probiotics. Microbiological control of the germs *Enterococcus faecium* M-74 appeared beneficial. Another valuable point to be taken into account is that the inclusion of Lactiferm into feed mixtures did not negatively affect the sensual properties of the feed and its intake.

Principal importance of this experiment is its economic aspect. In many countries, and especially developing ones, monogastric animals compete with humans for cereals consumption, which remain the key component of com-

mercial feed mixtures for poultry and pigs. Ascertained saving in feed consumption and high feed conversion offers the occasion of using the saved cereals for other purposes, for instance food for starving people (at present in Somalia, Ethiopia, Rwanda, etc.) or feed for other monogastric animals.

Obtained results were achieved from big capacity egg production system, in which we were requested for scientific collaboration. It was not possible to intervene into organizational and zootechnical conditions. However, it is possible to achieve interesting results under limited conditions.

Future research should link with the first Czech experimental results in the breeding as well as layers rearing. In the follow up research phases already ought to be, on representative scale and in the own very experiment, elucidated a range of problems, which remain interesting and useful.

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KOUDELA, K. – NYIRENDA, C. C. S. (Česká zemědělská univerzita, Agronomická fakulta, Praha, Česká republika):

Experimentální perorální aplikace probiotika Lactiferm kuřicím a nosnicím.

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Ve Společném zemědělském podniku pro výrobu vajec (SZP) Markovice, který je součástí Agrokomplexu Kutná Hora, byla vůbec poprvé u nás i v zahraničí v praktických chovatelských podmínkách komplexně prověřena experimentální kontinuální aplikace probiotika Lactiferm (výrobce MEDIPHARM CS Hustopeče u Brna). Do pokusu bylo zařazeno 155 538 kuřic a 127 043 nosnic finálního hybrida Shaver Starcross 288 (dodavatel jednodenních sexovaných kuřat ŠPĽP Nitra).

Probiotikum Lactiferm L-50 (premix-koncentrát) obsahovalo 5 . 10^9/g *Enterococcus faecium* M-74, NCIB, Aberdeen. Trojnásobnou triturací se probiotikum inkorporovalo do komerčních krmných směsí K, K-Z a N (dávkování Lactifermu 30 g/t).

Pokusné kuřice i nosnice přijímaly testované probiotikum bez jakýchkoliv obtíží a druhotných negativních vlivů na kvantitu i rytmicitu příjmu krmiva. Během pokusného období (1990–1992) byla celkem sedmkrát mikrobiologicky prověřována životnost zárodků *Enterococcus faecium* M-74 v komerční krmné směsi, která byla odebírána jak ze sila, tak i přímo z krmných žlabů. Exaktně nebyly zjištěny žádné příznaky termo- a chronolability prověřovaných zárodků.

Kontinuální experimentální aplikace testovaného probiotika se jednoznačně osvědčila, a to jak stimulací užitkových vlastností pokusných kuřic a nosnic, tak optimalizací vnitřního prostředí a výrazně ekonomickou úsporností.

Zevní a vnitřní prostředí nejintimněji spojuje výživa, které jsme proto věnovali maximální pozornost. Kontinuální experimentální aplikací probiotika Lactiferm se u dvou pokusných skupin celkem 72 240 kuřic snížil příjem krmiva v období odchovu o 2,17 g krmné směsi za 1 den ve srovnání s kontrolními kuřicemi (celkem 83 298 kusů). Za celé období odchovu se u jedné pokusné kuřice snížil příjem krmiva v průměru o 243,04 g. V obou pokusných halách se jednalo o úsporu 17,311 tun krmné směsi, což představuje finanční úsporu 432 775 Kč v cenách z roku 1990 a po přecenění v roce 1992 pak 706 032 Kč. Náklady na Lactiferm a jeho vpravení do kompletní krmné směsi dosáhly částky 72 963 Kč.

Na 1 kg přírůstku živé hmotnosti se u pokusných kuřic spotřebovalo o 709 g krmné směsi méně než u kuřic kontrolních. Bezprostřední úspora ve spotřebě krmné směsi tedy představuje u pokusných kuřic 50,509 tun v ceně 2 272 905 Kč. Spotřeba krmné směsi na 1 vejce byla u tří kontrolních skupin nosnic (62 682 kusů ve třech halách) vyšší v průměru o 12,6 g ve srovnání se třemi skupinami nosnic pokusných (64 261 kusů ve třech halách). Rozdíl ve spotřebě krmné směsi mezi nejlepší pokusnou a nejhorší kontrolní skupinou nosnic dosáhl 22,7 g. Rozdíly ve spotřebě krmné směsi na tvorbu 1 vejce mezi nejhorší pokusnou a nejhorší kontrolní skupinou nosnic představovaly v průměru 17,33 g.

Celý originální pokus ve SZP Markovice se uskutečnil na vyžádání Agrokomplexu Kutná Hora a jeho provedení dokumentuje možnosti cílené poradenské činnosti a vazby zemědělských podniků a pracovišť České zemědělské univerzity v Praze. Při denní produkci 180 000 vajec a při experimentálně potvrzené prospěšnosti kontinuální aplikace probiotika Lactiferm, která se projevila úsporou 12,6 g krmiva na produkci 1 vejce, dosahuje teoretická úspornost spotřeby kompletní krmné směsi v SZP Markovice 226,8 kg. Při roční produkci přibližně 55 700 000 vajec by se tedy mohlo aplikací probiotika Lactiferm ušetřit přibližně 701,82 tun krmiva v ceně přibližně 31 581 900 Kč (v cenách krmných směsí roku 1992).

kur domácí; výživa; probiotikum; Lactiferm; užitkové vlastnosti

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