THE EFFECT OF GENOTYPE ON TECHNOLOGICAL QUALITY OF EGGS

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Technological quality of eggs has been studied in six various brown-egg genotypes: final hybrid D 102 pedigree hatched (D 102-rod), White Leghorn x Red Rhode Island (LB x RIR), fast-feathering Red Rhode Island (RIR-R), final hybrid D 102, brindled Plymouth Rock x Red Rhode Island (PŽ x RIR) and Red Rhode Island slowly-feathering (RIR-P). Laying hens were fed on ordinary commercial feed mash containing 14.49% of crude proteins. Egg quality was studied between 20th-56th week of laying hens' age. Significant differences between genotypes were found in the weight of eggs where highest weight was recorded with genotype LB x RIR. This genotype had also significantly highest weight of egg shell. As to the percentage of egg shell, no significant differences were found. Significantly highest shell strength had the genotype PŽ x RIR. Of indicators of egg yolk and white, significant differences were found only in average egg white weight. The often presented dependence between egg weight and weight of different parts has been confirmed. Relatively high occurrence of blood- and meat-spotted eggs was found – the percentage of occurrence was rising with ingoing time of laying.

hen; laying type; technological value of eggs

INTRODUCTION

In breeding of new laying hybrids and testing of different combinations of crossings of hens, it is necessary to study, among indicators of feed consumption and egg production, technological value of eggs. This value, particularly the weight of eggs and quality of shell, affects economy of production to a considerable degree.

The egg weight is an important indicator of egg performance, because between it and weight of different parts of egg, especially between weight of egg yolk and white, is a highly positive correlation (R o u s, 1972; I z a t et al., 1985). However, despite this positive correlation some parts of egg can change their weight in relationship to the whole, as the egg weight and weight of different parts is affected by a lot of genetic and non-genetic factors as well.

These factors affect the quality of egg shell. It is a known fact that the shell quality falls, e.g. with age of laying hens. P e t e r s e n (1965) proved that this fall was caused by lower usability of calcium for calcification with increasing age of laying hens. It can be given that the increase of disorders and age of laying hens is in direct correlation with size of egg, for the greater eggs have a tendency to thinning of shell. It follows from some literary data that about 10% of the weight of the whole egg fall to the shell of good quality and critical values is the limit of 9% of the egg weight (C o t t e r i l l, G e i g e r, 1977; W e l l s, B e l y a v i n, 1987; T ů m o v á et al., 1993). Genotype correlations from –0.06 to 0.35 were found between egg weight and strength of shell (V a n T i j e n, K u i t, 1970).

Shell weight and strength depend not only on the size for eggs but also on thickness of the shell. Significant differences among various genotypes can be found here. D a m m e et al. (1982) found different coefficients of shell weight regression and egg weight in various hybrids. No doubt, that in the strength of shell exist significant differences among reared hybrid laying hens. D a m m e et al. (1982) found highly significant differences between different lines in percentage of egg shell, yolk and white of the egg weight.

An important indicator is also percentage of egg yolk and white of the total egg weight. H a l a j and A r p á š o v á (1995) who studied performance of hens in laying hybrids Shaver Starcross 288 in the first and second laying cycle found that with higher age of laying hens the percentage of egg white was falling, and vice versa, the percentage of egg yolk was increasing. In evaluation of yolk quality, colour of yolk in connection with egg quality is often mentioned. Coefficients of heritability of yolk quality are presented below ($h^2 = 0.12–0.15$), unlike coefficients of white quality which are relatively high and vary in the values $h^2 = 0.30–0.60$ (S k ř i v a n, 1990).

In connection with the evaluation of the egg quality it is necessary to mention occurrence of blood and meat spots in eggs. The effect of genotype is most often presented, as great differences were found between white-egg and brown-egg laying hybrids (A n o n y m u s, 1988; T ů m o v á, S k ř i v a n, 1994).

MATERIAL AND METHOD

The aim of the investigations was to find the effect of genotype on the egg quality in the pilot trials.

The trial included six brown-egg genotypes bred by an enterprise for breeding and reproduction of poultry Dominant Dobřenice, CR: final hybrid

D 102 pedigree-hatched (D 102-rod), White Leghorn x Red Rhode Island (LB x RIR), fast-feathering Red Rhode Island (RIR-R), final hybrid D 102, brindled Plymouth Rock x Red Rhode Island (PŽ x RIR) and slowly-feathering Red Rhode Island (RIR-P). These groups of hens were fed on ordinary commercial feed mash containing 14.49% of crude protein.

Investigations were carried out in pilot conditions of the School Agricultural Enterprise Lány, farm Suchdol, in the BIOS House, of the size 30 x 10 m. Laying hens were placed in the triple Flat-Deck cages produced by STS Hostivice. Experimental groups were distributed in the house in such a way to eliminate the effects of medium as much as possible. During egg production intensity of light was 3.2 W/m^2 what represents roughly 10 lux.

The egg quality has been studied between 20th and 56th week of laying hens' age and evaluations were performed in 28-day intervals. 9 analyses were done and 540 eggs were evaluated for each genotype. The egg weight, index of egg shape, data relating to the egg shell quality (weight after sucking out, percentage, thickness, strength), egg yolk quality (average weight, percentage, colour and yolk index), and average weight, percentage and white index and further an occurrence of blood and meat spots in eggs.

Shell strength was evaluated by the device for measuring of shell deformation KOLUMBUS M, colour of yolk by the scale La Roche.

Results were processed by the program STATGRAPHICS and significance was settled by the Sheffe method. Statistically significant differences are in tables denoted by various letters.

RESULTS AND DISCUSSION

It is evident from the results (Tabs. I to IV) that significantly highest weight of eggs was achieved by the genotype LB x RIR, followed by RIR-R, final hybrid D 102-rod, and final hybrid D 102. The results of the previous trial (A r e n t et al., 1997) in which the given genotypes were investigated during administration of various feed mashes were not confirmed too much.

Statistically significant differences in the investigated genotypes were not found among the values of indices of egg shape and results are comparable with usually presented data (S k ř i v a n, 1990; T ů m o v á et al., 1993).

Average egg shell weight was significantly highest in the genotype LB x RIR 6.89 g ($P < 0.05$), followed by the genotype RIR-R (6.82 g) and in the final hybrid D 102-rod (6.77 g). It can be concluded that egg shell weight copied the average egg weight, because the given genotypes reached the highest average egg weight in the same sequence. Percentage of the shell when no significant differences were found among investigated genotypes was highest in the genotype PŽ x RIR. Data characterizing percentage of shell

I. Egg weight and egg shape index

Genotype	n	Average egg weight (g)	Egg shape index
D 102-rod	540	63.34[abc]	77.43
LB x RIR	540	64.04[c]	77.99
RIR-R	540	63.66[bc]	77.83
D 102	540	62.54[ab]	77.10
PŽ x RIR	540	62.38[a]	77.29
RIR-P	540	62.47[a]	77.53

a, b, c – $P \leq 0.05$

II. Indicators of egg shell quality

Genotype	n	Average shell weight (g)	Shell percentage (%)	Shell thickness (mm)	Shell strength (N)
D 102-rod	540	6.77[ab]	10.66	0.339	32.45[a]
LB x RIR	540	6.89[b]	10.80	0.349	32.90[ab]
RIR-R	540	6.82[ab]	10.73	0.345	33.86[abc]
D 102	540	6.67[a]	10.71	0.342	34.50[bc]
PŽ x RIR	540	6.74[ab]	10.82	0.343	35.00[c]
RIR-P	540	6.72[ab]	10.79	0.343	34.33[bc]

a, b, c – $P \leq 0.05$

reach somewhat higher values than those reported by Cotterill, Geiger (1977) and Wells, Belyavin (1987) but are fully corresponding with the results presented by Skřivan (1990). Statistically significant differences were found neither in shell thickness which ranged around 0.34 mm and is comparable with the literary data. Significant differences were found in shell strength where the highest values were reached by the genotype PŽ x RIR, namely 35.0 N ($P < 0.05$).

Indicators of yolk and white quality are fully confirmed by frequently presented positive correlation between egg weight and yolk and white weight. Average yolk weight did not show significant differences among genotypes, the same applies to the percentage of egg yolk. The highest yolk weight was attained by the genotype LB x RIR, which had also highest white weight at the simultaneous highest egg weight. In the same sequence like in the yolk weight followed the genotypes RIR-R and D 102-rod, as in the yolk weight,

III. Indicators of egg yolk quality

Genotype	n	Average yolk weight (g)	Yolk percentage (%)	Yolk index	Colour of yolk
D 102-rod	540	17.20	27.07	45.68	5.40
LB x RIR	540	17.33	27.08	45.82	5.62
RIR-R	540	17.22	27.04	46.18	5.83
D 102	540	16.97	27.16	46.15	5.55
PŽ x RIR	540	16.94	27.17	46.53	5.61
RIR-P	540	16.93	27.15	46.32	5.55

IV. Indicators of egg white quality

Genotype	n	Average white weight (g)	White percentage (%)	White index
D 102-rod	540	39.37[ab]	61.91	9.07
LB x RIR	540	39.82[b]	62.12	9.23
RIR-R	540	39.63[ab]	62.22	9.52
D 102	540	38.89[ab]	62.14	9.46
PŽ x RIR	540	38.72[a]	62.01	9.65
RIR-P	540	38.82[ab]	62.06	9.69

a, b, c – $P \leq 0.05$

as in the white weight. Significant differences were found among some values of white weight, but in the percentage of egg white they were not found.

Significant differences were neither among the values of index of yolk and white shape, nor among the values of the yolk colour. The obtained results of these indicators are fully comparable with the data reported by Skřivan et al. (1990) and Tůmová et al. (1993).

The percentage of blood- and meat-spotted eggs with respect to the fact that these were brown-egg genotypes was high and ranged from 15.56% (D 102-rod) to 25.19% in the genotype D 102. It is necessary to mention here that our maximum values exceed also data of brown-egg laying hens as reported by Anonymus (1988) and Skřivan (1990) ranging from 13.18 to 22.06%. With continuing time of egg production the percentage of occurrence of blood- and meat-spotted eggs was increasing. This trend has been emphasized also by Tůmová and Skřivan (1994).

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Vliv genotypu na technologickou hodnotu vajec.

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Technologická hodnota vajec je zejména v poslední době jedním z ukazatelů charakterizujících výrobu vajec, neboť obzvlášť hmotnost vajec a kvalita skořápky do značné míry ovlivňují ekonomiku výroby.

Cílem pokusu bylo porovnání kvality vajec u šesti různých hnědovaječných genotypů, vyšlechtěných podnikem pro šlechtění a rozmnožování drůbeže Dominant Dobřenice, ČR: finální hybrid D 102 líhnutý rodokmenově (D 102-rod), leghornka bílá x rodajlendka červená (LB x RIR), rodajlendka červená rychle opeřující (RIR-R), finální hybrid D 102, plymutka žíhaná x rodajlendka červená (PŽ x RIR) a rodajlendka červená pomalu opeřující (RIR-P). Nosnice byly krmeny běžnou obchodní krmnou směsí o obsahu 14,49 % dusíkatých látek.

Kvalitu vajec jsme sledovali od 20. do 56. týdne věku nosnic, laboratorní hodnocení jsme prováděli v 28denních intervalech.

Nejvyšší hmotnost vajec (64,04 g; $P \leq 0,05$) jsme zjistili u genotypu LB x RIR. Hodnoty indexu tvaru vejce se mezi genotypy průkazně nelišily. Průměrná hmotnost skořápky byla průkazně nejvyšší také u genotypu LB x RIR (6,89 g; $P \leq 0,05$). Nejvyšší procentuální podíl skořápky (10,82 %; $P \leq 0,05$) byl zjištěn u genotypu PŽ x RIR, který měl i průkazně nejvyšší pevnost skořápky (35,00 N; $P \leq 0,05$). Vliv genotypu se výrazněji neprojevil u tloušťky skořápky, kde nejvyšší hodnoty dosáhl opět genotyp LB x RIR.

Nejvyšší hmotnost žloutku (17,33 g) byla zjištěna u genotypu LB x RIR, nejvyšší procentuální podíl žloutku (27,17 %) u genotypu PŽ x RIR. U obou těchto ukazatelů ani u barvy žloutku nebyly zjištěny mezi genotypy signifikantní rozdíly. Významné rozdíly mezi některými genotypy byly však u průměrné hmotnosti bílku, kde nejvyšší hodnota byla opět zaznamenána u genotypu LB x RIR, a to 39,82 g ($P \leq 0,05$). Statisticky významné rozdíly nebyly prokázány u podílu bílku ani u indexu bílku. Byl zjištěn poměrně vysoký podíl krevních a masových skvrn ve vejcích (15,56–25,19 %). Výskyt těchto skvrn se zvyšoval s postupující dobou snášky.

slepice; nosný typ; genotyp; technologická hodnota vajec

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