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Basic Production Parameters of Small Capacity Broiler Farms in the Region of Banja Luka

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Abstract

This paper presents the basic production parameters of seven broiler farms with a capacity of 6,000 birds per round in the Banja Luka region, obtained by analysis of production records of 70 rounds, achieved in 2013-2014. Methods of descriptive statistics, one-way analysis of variance and correlation analysis were used. Average values of production parameters were as follows (M±SD): day-old chick weight 43.04±2.63 g; fattening duration 38.91±2.55 days; final chick weight 2.13±0.24 kg; feed conversion ratio 1.80±0.07; total mortality rate 4.07±1.95%, and European production efficiency factor 291.14±22.50. Significant differences were found for average total mortality rate among broiler farms and feed conversion ratio between production years ($p < 0.05$). Fattening duration was in positive correlation with feed conversion ratio (0.76, $p < 0.01$), final chick weight (0.90, $p < 0.01$), but in negative with EPEF (-0.28, $p < 0.05$). Comparable production performances could be related to uniform the technology and similar requirements of meat industry, although comprehensive research is suggested for reliable evaluation of broiler farm productivity in the Banja Luka region.

Key words: broiler chicken, fattening, production efficiency

Introduction

The intensive fattening of broiler chickens is a system of meat production, characterized by good cost-effectiveness and unlimited advantage of chicken meat in nutrition of people of different ages, health, lifestyle, or religion.

Estimated annual consumption of poultry meat in Bosnia and Herzegovina is around 15.00 kg per capita, and the expected trend of further growth is favorable due to its competitive price, consumption tradition, and reputable domestic production and processing capacities (Salihbašić et al., 2015; Zenunović & Glavić, 2017).

Commercial broiler meat production in the Republic of Srpska integrates farms of parental flock, hatcheries, farms for fattening, processing capacities, as well as market of meat and its products. Fattening is mainly managed by farmers - cooperators, who provide fattening capacities and labor as necessary inputs, while chicks, feed, production control, and health care are provided by the production organizer (Salihbašić et al., 2015; Zenunović & Glavić, 2017). The technology of fattening is based on principles of intensive production: farms are mostly typical structures adapted to the floor system; heavy hybrid lines (commonly Cobb 500, Ross 308 or Hubbard) are used; nutrition, microclimatic conditions, health care, and biosecurity are strictly adjusted to hybrids' requirements (Mitrović et al., 2005; Mitrović et al., 2010; Pandurević, 2010).

A farm's production records can give good insight into organizational, technical, and economic issues in the live sector. Average daily gain, feed conversion ratio, final body weight, mortality rate, and fattening duration are commonly used in the estimation of success of live production in broiler farms (Leeson, 2000; Szőllősi et al., 2014; Györke et al., 2016; Tandoğan and Çiçek, 2016). A more accurate estimation in comparison of different farms can be made by using the European production efficiency factor (EPEF), an aggregate value calculated on basis of several production parameters (Shane, 2013). The production performance of broiler farms, despite a high degree of unification and intensity of technology, is subject to variation, and can be influenced by a number of factors, such as location, capacity and technological equipment of the farm, climate, transport conditions and quality of day-old chicks, feed and water quality, microclimate, the length of period between rounds and growers' competence (Sasaki et al., 2014; Mesa et al., 2017; Utnik-Banaś et al., 2018). Acceptable production performance in our conditions, as well as its dependence on housing density, fattening duration, and day-old chick weight or hybrid provenience have been reported by Mitrović et al. (2005), Mitrović et al. (2010), and Pandurević (2010).

The aim of this study was to present the average values and variability of basic production parameters achieved in broiler farms in the Banja Luka region.

Material and Methods

The study was based on data from production records of 10 rounds of Cobb 500 chicken, obtained on seven farms with a capacity of 6,000 broiler chicken per round each in the Banja Luka region in 2013-2014, a total sample consisting of 70 rounds. The analysed farms were typical structures adapted to the floor system, made of brick, and equipped with an automatic chain type of feeders and nipple drinkers, as well as with a central heating system and roof ventilation, and a straw as bedding material. Nutrition and health care were identical in all farms included. Values for the following production parameters were taken from production records, or calculated according to the appropriate equation: day-old chick weight (g); total mortality rate (%) = (number od dead chicks / initial number of chicks) x 100; feed conversion ratio = (total consumed feed / total live weight); final chick weight (kg); fattening duration (days) and the European production efficiency factor (EPEF) = (average body weight x livability) / (feed conversation ratio x fattening duration) x 100. Statistical analysis was performed by using the methods of descriptive statistics, one-way analysis of variance and simple correlation analysis in Microsoft Excel 2010.

Results and Discussion

A total of 70 rounds were realized in seven analyzed broiler farms during 2013-2014 (10 rounds on each farm). Average values and variability of basic production parameters of all fattening rounds in this production period are presented in Table 1.

Tab. 1. Average values and variability of basic production parameters
Просјечне вриједности и варијабилност основних производних параметара

Parameters	Mean	Min	Max	Std. Dev.	Coef. Var.
Fattening duration, days	38.91	35.00	44.90	2.55	6.55
Day-old chick weight, g	43.04	36.50	47.00	2.63	6.11
Final chick weight, kg	2.13	1.60	2.75	0.24	11.20
Feed conversion ratio	1.80	1.68	1.98	0.07	3.95
Total mortality rate, %	4.07	1.34	10.60	1.95	47.90
EPEF	291.14	244.53	361.94	22.50	7.73

Fattening duration varied from 35.00 to 44.90 days, the weight of day-old chicks ranged from 36.50 to 47.00 g, final weight values ranged from 1.60 to 2.75 kg, whereas average values for these parameters were 38.91 days, 43.04 g and 2.13 kg, respectively. Minimum and maximum value for feed conversion ratio was 1.68 and 1.98, with an average value of 1.80. Total mortality rate varied from 1.34 to 10.60% with an average value of 4.07%. The EPEF averaged 291.14 varying from 244.53 to 361.94. The lowest coefficient of variation (3.95%) was obtained for feed conversion ratio, whereas the highest variation (47.90%) was found for total mortality rate.

Basic production parameters, categorized by broiler farms in this production period, are presented in Table 2. The parameters considered had comparable values, except the value of total mortality rate ($p<0.05$).

Tab. 2. Basic production parameters (M±SD) by farms
Основни производни параметри (M±SD) по фармама

Farms	Fattening duration, days	Day-old chick weight, g	Final chick weight, kg	Feed conversion ratio	Total mortality rate, %	EPEF
1	39.29±1.75	44.01±2.87	2.23±0.15	1.81±0.06	3.23± 0.67[bc]	303.42± 13.39
2	40.64±2.87	44.55±1.83	2.29±0.29	1.85±0.08	7.27± 2.37[a]	282.19± 20.15
3	39.35±2.06	42.65±1.39	2.06±0.22	1.81±0.07	4.42± 1.49[b]	276.20± 12.87
4	38.66±2.49	43.05±2.96	2.04±0.20	1.79±0.06	3.66± 0.97[bc]	282.43± 23.09
5	38.43±2.83	42.51±2.88	2.13±0.20	1.79±0.07	4.12± 1.29[b]	297.36± 28.74
6	37.62±2.51	41.74±2.96	2.03±0.29	1.77±0.06	2.13± 0.58[c]	297.33± 24.82
7	38.42±2.74	42.78±2.78	2.13±0.24	1.79±0.09	3.64± 0.97[bc]	298.06± 21.10

Note: [abc] – Values in the same column with different superscripts are statistically different at $p<0.05$

The values of basic production parameters for each production year are presented in Table 3. Feed conversion ratio was higher in 2014, compared to 2013 ($p<0.05$), while other parameters did not differ significantly.

Tab. 3. Basic production parameters (M±SD) by production years

Основни производни параметри (M±SD) по производним годинама

Pro-duction year	Fattening duration, days	Initial chick weight, g	Final chick weight, kg	Feed conversion ratio	Total mortality rate, %	EPEF
2013	38.45±0.37	43.35±0.43	2.07±0.03	1.77±0.01[b]	4.44±0.37	291.65± 3.72
2014	39.37±0.48	42.73±0.46	2.18±0.05	1.84±0.01[a]	3.69±0.28	290.63± 3.94

Note: [abc] – Values in the same column with different superscripts are statistically different at p<0.05

The Pearson's correlation coefficients between fattening duration and other production parameters are shown in Table 4. Positive correlation was found with final chick weight and feed conversion ratio (0.76, 0.90, p<0.01, respectively), while it was negative with the EPEF (-0.28; p<0.05).

Tab. 4. The Pearson's correlation coefficients between fattening duration and basic production parameters

Пирсонов коефицијент корелације између дужине това и основних производних параметара

Parameters		Final chick weight	Feed conversion ratio	Total mortality rate	EPEF
Fattening duration	r	0.76	0.90	0.20	-0.28
	Sig.	**	**	NS	*

Note: NS – Non-significant; * Significant at p<0.05; ** Significant at p<0.01

The average values of production parameters and their variability, found in this research, are comparable with the results of Mitrović et al. (2010). These authors analysed performances of one broiler farm in the region of Semberija in 2004-2009, and found the following values of productive parameters: fattening duration 38.49 days (34.50-44.00), final body weight 2.023 kg (1.798-2.380 kg), feed conversion ratio 1.719 (1.612-1.889), mortality rate 3.24% (2.13-4.99%), and the EPEF 296.32 (260.11-322.83).

Initial chick weight, as one of the key production factors in the early period of fattening, had relatively wide range of variation (35.00-47.00 g), which is possibly affected by numerous factors out of a broiler farm, such as quality and age of parent flock, egg weight and storage as well as incubation

technology, duration and conditions of chick transport to the farm (Milošević & Perić, 2011). A similar range of initial chick weight in commercial broiler fattening (38.0-46.0 g) has been reported by Mitrović et al. (2005). Final weight and feed conversion ratio were observed in relation to fattening duration, therefore significant differences among farms were not found for these parameters. When relations between fattening duration and feed conversion ratio as well as with final chick weight were examined by correlation analysis, the obtained Pearson's coefficients indicated that these parameters increased with rising fattening duration (0.90 and 0.76, p<0.01, respectively). An increase of feed conversion with prolongation of fattening duration was reported by Samarakoon and Samarasinghe (2012) or Schmidt (2008) in commercial production. Mitrović et al. (2006) did not find such correlation, while their later study (Mitrović et al., 2010) showed that it existed (0.745, p<0.01), as well as with final body weight (0.831, p<0.01). By comparing the data from this research with average production data of selected countries in the European Union achieved in the relatively same period (Horne & Bondt, 2014), it was noted that final body weight was lower (2.13 vs. 2.28 kg), and feed conversation ratio higher (1.80 vs. 1.76). However, when average values of individual countries in that report were compared, then values from this study are within variation recorded for final weight (1.92-2.70 kg) and feed conversion (1.65-1.95). The efficiency of food utilization is influenced by microclimate conditions on a farm, nutritional factors, age, sex and health of broilers, the grower's knowledge and competence, as well as the season (Leeson, 2000; Mitrović et al., 2010; Sasaki et al., 2014; Mesa et al., 2017). Simsek and Ozhan (2015), for instance, reported comparable final chick weight and feed conversion ratio at farms of three different capacities, which is supported by the results of Tandoğan and Çiçek (2016) obtained in the analysis of commercial broiler farms also with three different capacities. But, El-Tahawy et al. (2017) confirmed the effect of farm capacity on these two parameters. Feed, as a part of variable costs of a broiler farm, makes the largest share in total costs, so feed conversion is one of the most important production parameters (Horne & Bondt, 2014; Zenunović & Glavić, 2017). However, feed conversion is a reliable indicator when comparing farms only if other factors of growth and feed consumption are negligible or identical. The shortening of fattening period significantly influenced cost-effectiveness of chicken meat production, compared to other species of domestic animals (Szőllősi et al., 2014).

Averge mortality rate in this study (4.07%) was below tolerable value for the hybrid used, but it was affected by the farm (p <0.05), the coefficient of variation being the highest among the analyzed parameters and especially increased values were observed on one farm. Similar values of this parameter

were reported by Mitrović et al. (2010) (2.13-4.99%), Györke et al. (2016) (4.24%), El-Tahawy et al. (2017) (2.73-5.10%) or Simsek and Ozhan (2015) (5.94-7.05%). The correlation between fattening duration and mortality rate in this research was not significant, which is in agreement with Mitrović et al. (2006), but the later research of Mitrović et al. (2010) confirmed this relation (0.430, $p<0.01$). Mortality rate could be affected by farm age and capacity, microclimate, a heating and ventilation system (Heier et al., 2002), season, parent flock genotype and age, egg storage duration (Yassin et al., 2009), day-old chick quality (Milošević & Perić, 2011), and chicken health status (Györke et al., 2016).

The average value of the EPEF in this study was 291.14, and all rounds had value greater than 200-225, as the minimum acceptable values in Europe, which indicates the necessity for a general analysis of all production factors (Shane, 2013). The average value of the EPEF in commercial production was 296.32 in the analysis done by Mitrović et al. (2010) or 298.802 in calculation by Tandoğan and Çiçek (2016). Variation in the EPEF value can be influenced by a genotype and sex of chick (Samarakoon and Samarasinghe, 2012) as well as housing density (Mitrović et al., 2005). Declining value of the EPEF with the extension of fattening duration, determined in this study, is consistent with the findings of Schmidt (2008) and Mitrović et al. (2010), although an earlier study by Mitrović et al. (2006) did not confirm this relationhip. The EPEF reflects the overall quality of farm conditions, chicks and fattening technology, so high production performance implies assuring high criteria for these factors, which could be demanding in practical production conditions (Utnik-Banaś et al., 2018). Consequently, technology of broiler chicken fattening is commonly adapted to local natural, technical, social and economic factors, especially in terms of production intensity, housing and feed quality, meat processing industry requirements and consumer affinity, which lastly define the broiler farm production performance. Also, reliable production data are essential for prompt implementation of corrective measures, intended to eliminate emergent problems or to achieve more productivity (Yassin et al., 2009; Sasaki et al., 2014).

Conclusion

The analysis of data from broiler farm production records revealed the following: generally satisfactory values of the basic production parameters have been achieved, significant differences have been observed for average total mortality rate among farms and average feed conversion ratio between two production years, and fattening duration significantly correlated with feed conversation ratio, final body weight and the EPEF.

Relatively comparable production performances could be associated with uniform fattening technology and housing conditions, similar requirements of meat processing industry regarding final chick weight, as well as with the farmer's responsibility and competences. More comprehensive research is necessary for reliable evaluation of broiler farm productivity in the Banja Luka region.

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Основни производни резултати фарми мањег капацитета за бројлерски тов пилића у регији Бања Лука

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Сажетак

У раду су приказани главни производни резултати седам фарми за бројлерски тов пилића капацитета 6.000 пилића по турнусу у регији Бања Лука добијених у анализи производне евиденције 70 турнуса остварених у 2013. и 2014. години. Подаци су обрађени методима дескриптивне статистике, једноструке анализе варијансе и корелационе анализе. Просјечне вриједности производних показатеља (M±SD) износиле су: маса једнодневних пилића 43,04±2,63 g; дужина това 38,91±2,55 дана; завршна маса пилића 2,13±0,24 kg; конверзија хране 1,80±0,07; укупан морталитет пилића 4,07±1,95% и европски производни индекс 291,14±22,50. Утврђене су значајне разлике у просјечном укупном морталитету пилића међу фармама у анализираном периоду, као и просјечној конверзији хране између турнуса остварених у 2013. и 2014. години (p<0,05). Дужина това била је у значајној и позитивној корелацији са конверзијом хране (0,76; p<0,01) и завршном масом пилића (0,90; p<0,01), али у негативној са европским производним индексом (-0,28; p<0,05). Упоредиви производни резултати могу бити у вези са унифицираном технологијом това и потребама месне индустрије, а за потпунију процјену производних резултата фарми за бројлерски тов пилића у региону Бања Лука предлаже се опширније истраживање.
Кључне ријечи: бројлерски тов, пилићи, производни резултати