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PRODUCTION LOSSES AND MORTALITY OF PHEASANTS DEPENDING ON CULTIVATION TECHNOLOGY IN VOLIERS, NUTRITION AND HUNTING CONDITIONS

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Abstract: The paper presents an overview of domestic and foreign studies of the influence of various factors on the production losses and mortality of pheasants in the parent flock, as well as young pheasants in the course of nurturing and after settling in the hunting ground. Production losses in the parent flock depend on the genetic structure of the birds, the size of the group, the relationship of the sexes, the arrangement of space in the pheasantry, the nutrition, the age of the females and the duration of the laying season. The state of physical condition and mortality of young pheasants in nursing affect: temperature, ventilation, nutrition, lighting, hygiene... The losses of young pheasants after settling in the hunting ground occur because of diseases and parasites, the lack of food (and water), and most of all because of predators. Compared to the number of eggs in the breeding flock, the number of young birds surviving to winter is only 7-10 per female pheasant. Due to such a small number and high production costs, maximum control of all procedures in the technology of cultivation of pheasant, nutrition and in settlement of the hunting grounds, as well as the division of jobs between the pheasantries in order to their specialization is necessary.

Keywords: pheasants, nutrition, losses, mortality, hunting, predators.

Introduction

Due to inadequate natural reproduction of pheasant and high hunting pressure, each year in Serbia a large number of young pheasants is reared in voliers, with the aim of settling them in hunting grounds at a certain age (Đorđević et al., 2011a). However, such a procedure is very expensive, not only because of direct costs (facilities and equipment, parent flock, feed, medicine, energy, work force...), but also because of a large percentage of losses, starting with the breeding flock (mortality of adult individuals, variability in bearing capacity, percentage of fertilization and percentage of incubated eggs), through the mortality of young pheasants in voliers, up to particularly large losses after settling in hunting grounds (diseases and parasites, adverse weather, lack of food and predators).

Deeming et al. (2011) state that the survival of artificially raised pheasants is much lower than pheasants born and raised in hunting grounds, primarily because of predators. Contrary to this, the lack of food is of minor importance and can be partially compensated by additional feeding of settled pheasants or by their adequate physical condition (physical body reserves) during settling (Đorđević et al., 2011b; 2012a). This problem occurs only in the second half of the year due to high temperatures and harvesting of large areas under monocultures, when there is less food and shelter. Due to the mentioned problems, more active hunting on the polygons is becoming more and more important today.

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Production losses in breeding flocks and during incubation of eggs

In Serbia, there are over twenty registered pheasants farms, some of which have a rounded production process (production of eggs in the parent flock, incubation of eggs and cultivation of pheasants chickens), and others only have pheasant chickens (originating from other pheasant farms). The losses of this species of game in the pheasant farms are mostly indirect, and they relate to a smaller number of laid, fertilized and hatched eggs.

The breeding technology of the breeding flock aims to produce as many eggs as possible per female pheasant and the higher the fertility of each egg (Đorđević et al., 2012c; 2013a).

These characteristics depend on the genetic structure of the breeding flock, the size of the group, the relationship of the sexes, the arrangement of the space on the pheasant farm, the diet, the age of the female pheasants and the duration of the bearing season (Esen et al., 2010). The number of laid eggs, their weight and fertility are particularly influenced by nutrition (Nowaczewski and Kontecka, 2005). Nutrition affects the number and size of the laid eggs directly through the necessary nutrients which are provided in the meal, or indirectly through the physical reserves which were provided in the earlier period. Considering the multiple bearing capacity of the female pheasants in the voliers, their needs are considerably higher than the needs of pheasants in nature. Urošević (2005) stated that under our conditions the average bearing capacity of female pheasants in the period April-June amounts up to 41-45 eggs, although according to Bojović 2012., under the conditions of the extended day, it can be up to 140 eggs. Such intensity and productivity require a good knowledge of the needs of the female pheasants. These needs were thoroughly examined and specified in some norms (Đorđević et al., 2014; 2015b). Apart from that, Bojović 2012. found a higher laying capacity in female pheasants that had a lower percentage of protein in the meal. The author's explanation is that the laying capacity, in addition to nutrition, is influenced by a large number of factors that vary from farm to farm. One of these factors is the way of keeping the individual birds. Kontecka et al. (2014) examined the effect of holding layers in a cage or a volier on the number of eggs laid. The cages were 1.5 m in size (lenght) × 1.5 m (width) × 0.5 m (height). In every cage there was a harem with nine females and one male. The density of the settlement was 4.4 birds /m^2. In each of the voliers there were 50 cocks and 400 laying hens were placed on an area of 900 m^2. The ratio of the sexes was 1: 8 and the density of the population of 0.5 birds /m^2. The established production results were better in the experiment with the cage system of holding (Table 1).

Ovoscoping of the eggs before placing them in the incubator is an important measure of elimination of non fertilized eggs, which increases the number of hatched eggs. However, on some of our pheasant farms, the classification of eggs is performed only according to their mass and shape, which has a negative influence on the results. It is accepted as satisfactory if the number of eggs hatched is around 85% of fertilized eggs. In an experiment, Popović et al. 2013. found 53.73 to 72.08% of eggs hatched, which is a consequence of the lack of ovoscoping of the eggs. Biological quality of eggs, incubator regimen and human involvement are of the significant importance for the results of incubation. Biological quality refers to the fertilization of eggs, the manner and length of keeping and the proper selection of eggs for the plantations. The fertilization is influenced by the structure of the main flock, the manner of holding, and the relationship of the sexes. The influence of nutrition on the biological quality of eggs is in correlation with the content of vitamins and minerals (Suchy et al., 2008). Fertilization of eggs in nature can be up to 96%, but due to large losses (up to 85%), the real increase in one female pheasant is very low. Cold and rainy periods, the

presence of unknown persons and other harassment of the breeding flock may have unfavorable influence on the ferilization (Popović and Stanković, 2009). Fertility is lower at the beginning and at the end of the laying season.

Table 1. Performance and hatchability results (%) of pheasants kept in different housing systems (Kontecka et al., 2014)

Trait	Housing system			
	cage		aviary	
	mean	SEM	mean	SEM
Laying rate	59.59*	2.59	27.23*	1.88
Hatching eggs	90.08	1.36	86.43	1.19
Small eggs	5.49*	0.43	6.50*	0.54
Cracked eggs	4.43*	0.24	7.07*	0.24
Dead embryos until day 8 of incubattion	2.67*	0.31	4.74*	0.55
Dead embryos until day 8 of incubattion, unhatched and crippled chicks	18.18	0.73	18.44	1.24
Hatchability from set eggs	61.74	3.79	63.02	1.69
Hatchability from fertilized eggs	79.06	0.87	79.98	1.45

Losses during breeding of young pheasants

Small pheasants are a very sensitive category of this type of game, in which significant losses occur due to inadequate temperature, ventilation, nutrition, lighting, hygiene (Đorđević et al., 2013b). The first phase of breeding of pheasants (12-15 days of age) is carried out in the battery holding system, after which it passes to the floor system (boxes or breeding cottages). After day 30, preparations for settlement in the hunting ground begins (Kokoszynski et al., 2008). In order to maximize the adaptation to the conditions of the hunting grounds, young birds are encouraged to search for food, as well as to stay away from the predators. Grain food is given on the ground during that period and the perches are installed. A characteristic of small birds to stay on trees during the night, acquired during the stay in voliers, is very important for the survival from predators (Whiteside et al., 2016). Apart from that, installation of perches in voliers influences the anatomic development of birds. In order to maximally prepare young pheasants for settlement in the hunting area, Santilli and Bagliacca (2017) compared a group of young pheasants raised in cottages (2.5×3.5 m) with perches installed at 30, 60 i 120 cm above the ground, with the group without perches in the objects. Perches contributed significantly to less breakage of feathers (2.1:2.3; $p<0.05$), increase of greater body mass, and to length and width of tarsus (Table 2).

One of the important factors for the technology of cultivation of young pheasant is the density of population. Đorđević et al. (2010) were investigating the influence of two protein levels and two density of population on the mortality of young pheasants (Table 3). During the first stage of rearing, the young pheasants were kept in cages on four floors, area 6.4 m^2 after treatment , and in the second stage of rearing on the floor, surface of 18 m^2, with an outlet of 70 m^2 per treatment. The experiment did not determine the significant influence of the investigated factors on the percentage of mortality, individually or as their interaction. In addition, mortality was far below the results of some previous research. For example, Braastad (1986) stated that mortality for 16 weeks, including death of birds caused by pecking, was from 2.0 to 8.7%. When comparing the production results in

two pheasant farms in Serbia, Popović and Stanković (2009) found the mortality of young pheasants up to day 40 in the first pheasant farm of 8.33 to 13.39%, and on the second pheasant farm of 3.60 to 4.74%. Otherwise, mortality could be increased due to overpopulation of voliers and the onset of cannibalism. Overpopulation occurs on pheasants farms with big parent flock and which deal with incubation of eggs and with production of young pheasants. At the peak of bearing capacity, a great number of young pheasants is present. Since there is not enough room for all of them, cannibalism occurs.

Table 2. Morphological measures collected at the 5th week of age (n=30 each subgroup) (Santilli and Bagliacca, 2016)

	Body weight, g	Tarsus length, mm	Max tarsus thickness, mm	Min tarsus thickness, mm
No perches				
Male	384.5a	60.97ab	6.65a	4.86a
Female	305.8b	57.72c	6.17b	4.55b
With perches				
Male	391.8a	62.09a	6.81a	4.83a
Female	321.9b	59.12bc	6.33b	4.60b
No perches	345.2	59.35	6.41	4.71
With perches	356.9	60.61	6.57	4.72
Standard error of mean	2.88	0.33	0.04	0.03
F values of tested effects				
Perches	4.12*	3.65*	3.73*	0.04ns
Sex	166.6***	22.2***	33.7***	25.8***
Interaction sex×perches	0.58 ns	0.04 ns	0.02 ns	0.64 ns

Table 3. Influence of protein levels and density on young pheasants mortality, % (Đorđević et al., 2010)

Proteins	Density	Period		
		0-15. days	15-42. days	0-42. days
26% SP up to 4 weeks of age and 20% SP from 4 up 6 weeks of age	450 birds/group	1.45^{ns}	1.00^{ns}	2.44^{ns}
	550 birds/group	0.73^{ns}	0.55^{ns}	1.27^{ns}
30% SP up to 4 weeks of age and 24% SP from 4 up 6 weeks of age	450 birds/group	2.78^{ns}	0.44^{ns}	3.00^{ns}
	550 birds/group	1.55^{ns}	0.91^{ns}	2.43^{ns}

Appropriate physical fitness obtained during the stay on pheasant farms is very important for the survival of young pheasants in the hunting grounds untill they learn to search for food. That is the reason why the feeding of young birds in voliers is done in adequate mixtures of concentrate, in accordance with normatives. Pekeč 2003. found out that the diet of pheasants with higher protein content leads to a significantly higher body weight (457.07:373.85 g). In addition, their gradual settlement (to the hunting area) from the shelter is practiced, where they receive food and water for some time, until they fully adjust to the conditions in the hunting ground.

Losses of young pheasants after settling in hunting grounds

After the spring period of the abundance of food of plant and animal origin in the hunting ground, due to the drought and the harvest of monocultures on large surfaces during the second

half of summer, there is less and less food and water for young pheasants that were recently inhabited. According to research in Ireland, about 70% of young birds aged 12 weeks die or die due to lack of food, parasitic infections and predators, which represents a huge loss and cost for hunting grounds (Popović et al., 2009). Especially large losses are made by carnivores, primarily foxes (Lanszki, 2005). It is believed that the poor physical condition of artificially raised pheasants inhabiting hunting grounds just fits the fox. Due to such high mortality, it is necessary to continue for some time with the feeding of 3-4 pounds of grain feed per 100 young birds after the release of young pheasants to the hunting area, and to implement the measures of control of the number of predators (Đorđević et al., 2012b, 2015a).

Winter feeding is most often the only way of feeding pheasants in the hunting grounds of Serbia. The aim of winter feeding is to reduce not only the losses of game, but also the preservation of its mass and fitness. Pheasants are extremely resistant birds and rarely die of starvation. However, in search of food, in cold weather and deep snow, they become much easier a predator prey (Lanszki, 2005). In order to achieve better results of additional nutrition, it is necessary to begin to accustom pheasants to feeds immediately after harvest. Additional feed consists of grains and possibly pelleted foods with a diameter of 3-5 mm, as well as juicy foods in days without frost. The daily amount of grain food is about 40-60 g per bird during winter. Plots under corn are effectively used during winter time (Gabbert et al., 2001), which also serve them both for food and shelter. Food is given to arranged or just improvised places.

Conclusion

Taking into account the laying capacity of female pheasants from some of our experiments (40-45), then the percentage of eggs which are put into incubator after classification (85-95), percentage of hatched eggs (55-70), percent of mortality of young pheasants in voliers (3-10) and the percentage of mortality after settlement into hunting grounds (up to 70), we come to the number of 7-10 young pheasants per female that would live until the next winter. Such a small percentage significantly increases the costs of pheasant production for hunting grounds. Therefore, it is necessary to have a maximal control of all steps in the technology of breeding of young pheasants, their feeding and the control of predators, in order to reduce production losses and mortality. In addition, it is recommended that "division" of jobs be carried out among the phases of the work, so that they are separately engaged either in keeping the parent flock and producing one day-old chicks, or just by raising young pheasants and preparing for settling in hunting grounds. By specializing in a particular type of work, pheasant farms could work more efficiently, with fewer production losses and mortality.

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