

INFLUENCE OF DIETARY PROTEIN LEVELS ON PRODUCTION RESULTS AND MORTALITY IN PHEASANTS REARED UNDER CONTROLLED CONDITIONS

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(Received 6th September 2009)

The effects of different levels of dietary protein content and population density in growing pheasants, up to the age of 42 days, on production results and mortality have been studied in this paper.

The experiment was set as a two factorial study (2 x 2). Factor A was the influence of crude proteins in the diet (A1 = 26% up to 4 weeks of age and 20% from 4 up to 6 weeks of age; A2 = 30% crude proteins up to 4 weeks of age and 24% from 4 up to 6 weeks of age). Factor B was the population density (B1 = 450 and B2 = 550 birds/group). The total number of birds in the trial was n= 2000. Body mass was measured at hatching, 15 and 42 days of age. Up to 15 days of age the pheasants were housed in cages, but thereon they were reared under floor conditions with free access to outdoors.

The highest body mass measured at 42 days of age (457.07 g) and the utmost daily body mass increase (4.22 for the first period of growth and 13.31 for the second) was achieved by the pheasants which were fed a diet with the highest protein content (30% in the first stage and 24% in the second) and reared at a lower population density (450 birds/group). These differences were significant ($p < 0.01$). On comparison with the available literature data the mortality was at a satisfactory level (1.27 - 3.00%) and was not influenced by the studied factors. The mortality values were numerically higher for all treatments for the period up to 15 days (0.73 - 2.70%) compared to the period from 15 up to 42 days of age (0.44-1.00%).

Based upon the obtained results and the previously published literature data it can be concluded that feedstuff protein content is the key factor required in order to obtain satisfactory final body weight and subsequently good quality material for the repopulation of hunting grounds.

Key words: pheasants, growth, conversion, mortality

INTRODUCTION

For a large number of hunters pheasants are the favorite game, not only for their meat characterized by low fat content and high essential fatty acids and amino acids content which makes it of a higher quality compared to broilers, duck and geese, but for hunting characteristics, as well (Tucak *et al.*, 2004; Adamski and Kuzniacka, 2006; Strakova *et al.*, 2006).

Natural production of pheasants in hunting grounds is insufficient due to the ever decreasing natural habitat, poor feeding conditions and increasing number of hunters. Supplementary feeding in hunting grounds may to a certain extent affect the number of birds (Hoodles *et al.*, 2001). As a result pheasants in captivity are bred under control, similar to broilers, and at a certain age are released in the wild (Brittas *et al.*, 1992). Pheasants bred in such a fashion have a poor survival rate, combined to losses resulting due to predators, parasites and condition failure. However, breeding and growing of pheasants under controlled conditions in captivity is of remarkable economical impact. Popović and Stanković (2009) state that the capacity of pheasant farms in Serbia is 900 500 hatched pheasant chicks. According to the authors during the previous four years more than ten million pheasants have been released to the wild.

It has been experimentally shown that by compensatory growth early weight gain losses due to poor feeding can be recuperated (Ohlsson and Smith, 2001). However, body mass of pheasants in the moment in which they are settling is very important for their survival when feeding conditions on the hunting grounds are poor. Due to the above, great attention is paid to pheasant nutrition in hatcheries. Feeding is at the beginning very intensive and is based mainly on concentrated feeds. Later on, feedstuff such as greens and grains is introduced in order to mimic natural feeding conditions (Kokoszynski *et al.*, 2008).

There are a number of recommendations which differ greatly in the quantity of nutrients. According to AEC (1987) pheasants' requirements for proteins are as follows: 24% for the first period from 0 to 4 weeks of age and 24% for the second period of growth. INRA (1984) recommendations are 23.1% - 28.7% crude proteins in the first phase and 14.8 - 17.2% during the second phase. Woodard *et al.* (1983) recommend 18% crude proteins for battery fattening of pheasants and 16% when floor reared. On the other hand reference values in the last years are increasing and range from 20 to 40% proteins (Sheppard *et al.*, 1998). According to NRP (1994) protein levels in feeds for the first phase of growth are 28% and 24% for the second period. Dietary protein level is relevant for production due to the fact that 50 - 80% of production expenses are for nutrition (Đorđević *et al.*, 2009).

The aim of this experiment was to study the effects of two different protein concentrations during two phases of pheasants' growth on production results and mortality at different population densities.

MATERIAL AND METHODS

In this trial the effects of two different feed protein levels and two population densities on body mass, daily weight gain, feed conversion and mortality were

studied. For the experiment the pheasant hybrid of subspecies *Phasianus colchicus cholchicus* *Phasianus colchicus mongolicus* and *Phasianus colchicus torquatus* was used. The experiment was set as a two factorial study (2 x 2) where factor A was the quantity of dietary crude protein ($A_1 = 26\%$ up to 4 weeks and 20% from week 4 up to 6 weeks of age; $A_2 = 30\%$ up to 4 weeks and 24% from week 4 up to 6 weeks of age) and factor B was the population density ($B_1 = 450$ and $B_2 = 550$ birds/group). The total number of birds in the trial was $n = 2000$.

In the first stage of breeding the pheasant chicks were reared in four floors cages with a surface of 6.4 m² per treatment. In the second stage the birds were kept on the floor, surface 18 m² with a run of 70 m² per group. The cage surface per bird was 0.014 m² (B_1) and 0.012 m² (B_2). The total floor surface was 0.20 m² (B_1) and 0.16 m² (B_2). Room temperature was at the beginning 38°C, lowered daily by 1°C down to 22°C. Body mass was measured at hatching, 15 and 42 days of life. For feeding two formulations with a unified composition of all nutrients except crude proteins (Table 1) were used. The used raw materials for the feedstuffs were equal, but different in the percentage present (Table 2). The chemical composition was determined by the standard AOAC methods (2002). The metabolic energy was calculated mathematically. Daily weight gain and feed conversion values were obtained mathematically. For each treatment a diary of mortality cases was kept up to date.

Table 1. Chemical composition of feed

Parameter	0-28. days		28-42. days	
	A ₁	A ₂	A ₁	A ₂
	% DM			
ME, MJ/kg	11.75	11.75	11.75	11.75
Moisture, %	10.57	9.27	9.52	9.62
Crude protein, %	26.09	29.88	20.17	23.97
Crude cellulose, %	3.53	4.31	4.02	3.23
Crude fats, %	6.08	7.33	4.14	4.00
Ash, %	6.68	7.00	5.60	5.89
Calcium, %	1.53	1.52	1.00	1.02
Phosphor, %	0.70	0.71	0.91	0.86

Statistical analysis of the obtained results was carried out with the software Statsoft (2006). The statistical significance of the observed factors was determined by analysis of variance and in the case of a positive result LSD - test was used to define the significance level between treatments.

Table 2. Feed ingredients

Feedstuff	Proteins, % DM			
	20	24	26	30
Corn	59.00	52.00	49.04	38.00
Soybean meal	24.08	31.46	30.00	40.00
Fishmeal	5.00	8.00	12.00	12.00
Aflaafila meal	5.00	2.00	2.00	2.00
Brewer's yeast	2.50	2.50	2.50	2.50
Dicalcium-phosphate	1.70	1.10	0.70	0.40
Methionine	0.12	0.14	0.06	0.10
Soy oil	1.00	1.00	1.50	2.50
Salt	0.20	0.20	0.10	0.40
Chalk	0.40	0.60	1.10	1.10
Mineral-vitamin supplement	1.00	1.00	1.00	1.00
Total, %	100.00	100.00	100.00	100.00

RESULTS

The measured body masses of the pheasants at hatching were uniform and ranged in the interval from 20.4 g to 21.08 g (Table 3). After 15 days of age the pheasants fed with a high protein content (30%) diet had a significantly higher body mass. The best results were obtained for pheasants kept at lower density population. The same trend was observed at 42 days of age.

Table 3. Production results

Protein	Density	Body mass, g			Daily liveweight gain (g/day)		Conversion, kg/kg	
		Age (days)			Period (days)		Period (days)	
		0	15.	42.	0-15.	15-42.	0-15.	15-42.
A ₁	B ₁	20.69	64.81 ^a	373.85 ^{ab}	2.94 ^a	11.03 ^{ab}	2.68 ^{ab}	3.31 ^c
	B ₂	20.90	59.23 ^a	336.53 ^a	2.55 ^a	9.53 ^a	3.53 ^b	3.10 ^{bc}
A ₂	B ₁	21.08	84.32 ^c	457.07 ^c	4.22 ^c	13.31 ^c	1.81 ^a	2.75 ^{ab}
	B ₂	20.40	72.88 ^b	408.04 ^{bc}	3.50 ^b	11.97 ^{bc}	1.97 ^a	2.51 ^a
Values for P								
A		0.82 ^{ns}	0.00 ^{**}	0.00 ^{**}	0.00 ^{**}	0.01 ^{**}	0.01 ^{**}	0.00 ^{**}
B		0.37 ^{ns}	0.01 ^{**}	0.03 [*]	0.02 [*]	0.06 ^{ns}	0.11 ^{ns}	0.07 ^{ns}
A x B		0.14 ^{ns}	0.29 ^{ns}	0.80 ^{ns}	0.42 ^{ns}	0.78 ^{ns}	0.24 ^{ns}	0.86 ^{ns}

a,b,c = values in the same column with different superscripts are significantly different ($p < 0.05$);
 ns = not significant; ** = $p < 0.01$; * = $p < 0.05$

During the first period of growth (0 - 15 days of life) a significantly higher daily liveweight gain was achieved by the chicks kept at a lower population density. The same trend was observed for the growth period from 15 to 42 days of life.

Pheasants fed a mixture containing a higher concentration of proteins had a higher feed conversion rate throughout the entire observed growth period.

A significant ($p < 0.01$) effect of feed protein content in the diet has been determined for all tested production parameters. Contrary to this, population density significantly influenced body mass in both observed periods ($p < 0.01$ and $p < 0.05$, respectively), daily liveweight gain in the first period ($p < 0.05$) while values for feed conversion varied independently. Interactions between the observed parameters could not be statistically established.

Mortality was higher during the first growth period compared to the second stage (Table 4). For the duration of the experiment mortality was between 1.27 and 3.00%, on the other hand the observed factors did not significantly influence the mortality rate.

Table 4. Mortality (%)

Proteins	Density	Period		
		0-15. days	15-42. days	0-42. days
A ₁	B ₁	1.45	1.00	2.44
	B ₂	0.73	0.55	1.27
A ₂	B ₁	2.78	0.44	3.00
	B ₂	1.55	0.91	2.43
Values for P				
A		0.09 ^{ns}	0.56 ^{ns}	0.28 ^{ns}
B		0.07 ^{ns}	0.46 ^{ns}	0.22 ^{ns}
A x B		0.77 ^{ns}	0.22 ^{ns}	0.62 ^{ns}

^{ns} = not significant

DISCUSSION

Body mass of pheasants, otherwise known as body condition, is of great importance at the moment of their release to the wild. Body reserves accumulated in the previous period are crucial for their survival in the wild as they are needed to compensate any food deficit (Bagliacca *et al.*, 1996). As a result mortality is decreased and the number of pheasants on the hunting grounds can improve. The insignificant differences in body mass of pheasants measured at the very start of the trial indicate that the observed birds are uniform. Thus, it can be concluded that the differences recorded at 15 and 42 days of age are the result of the influence of tested parameters (dietary protein content and population density).

Practically, body mass of newly hatched chicks can vary due to a number of factors one of which is the nutrition of the layer pheasant hens whose eggs are incubated. Beuković (1999) has used three different feeds with 22%, 19% and 16% crude proteins but with equal metabolic energy in each feed (11.71 MJ). Resulting body masses of hatched chicks were 21.87, 21.59 and 21.09 g, respectively. The highest average body mass was recorded for the chicks hatched from eggs laid by hens fed the highest concentration of crude proteins. Moreover, feeding of the breeder flock affects the number of laid eggs (Usturoi, 2008) and egg fertility (Nowaczewski and Kontecka, 2005). Ipek and Dikmen (2007) have shown that from larger eggs chicks with a bigger body mass are hatched. There is no significant influence of egg mass on pheasant chick mortality. The authors have classified the eggs according to weight into three groups (27.8-29.7; 29.8-31.7 and 31.8-33.7 g) and thus described the respective body weights of the hatched chicks to be 19.5, 21.8 and 22.6 g ($P < 0.01$).

When measured at 15 days of age body masses varied in the interval from 59.23 to 84.32 g and were significantly under the influence of both tested parameters. The obtained results are close to the values obtained in previous studies. Pullianen (1965) stated that body mass of 15 days old pheasants is 75 g, but according to Nadaždin *et al.* (1995) it is 85 g. Glamović *et al.* (1995) report that body mass of 15 days old pheasants varied in the interval from 58.5 to 81.67 g. Scott *et al.* (1960) account that pheasant body mass is influenced by other dietary components such as salt (NaCl). The authors report that if the meal does not contain salt the body mass of pheasants measured at 28 days of age is 87 g, however when to the feed was added 0.25% salt the body mass doubled up to 193 g. Body mass of 42 days old pheasants was dependant on protein level and population density and ranged in the interval from 336.53 g to 457.07 g. For this period of life a statistically significant influence of both factors was observed. Cain *et al.* (1984) have studied different protein levels in the feed at three pheasant population densities (0.19, 0.38 and 0.74 m²/bird) on body mass. They have established a statistical significance of the impact of population density on body mass. The importance of feed protein level on body mass has been described by a number of authors (Jović, 1964; Rizvanov *et al.*, 1984; Kolous and Stradal, 1988; Melin and Larbier, 1988; Beuković, 1999; Bagliacca *et al.*, 1996; Ohlsson and Smith, 2001).

Rizvanov *et al.* (1984) fed experimental pheasants with a diet containing 25, 28, 30 and 35% crude proteins. Average body mass at 50 days of age was 401.3, 434.3, 452.3 and 451.2 g, respectively. Differences for groups receiving 30 and 35% proteins were minimal and insignificant. This meaning that after a certain level there is a physiological point after which no further increase in protein concentration can result in additional liveweight increase. In such cases the protein surplus can be used a source of energy (Pack, 1996) which is a rather irrational use of valuable proteins. Pekeč (2003) states that a high crude protein concentration in the feed can result in increased mortality due to liver and kidney damage. Thus the recommendation to adjust to a lower protein feed at 4 weeks of pheasant's age. Sage *et al.* (2002) report that pheasants fed a high protein diet had deposited more fat tissue in the cloacal region, while the difference in body

mass was insignificant. Biological availability of nutrients and growth intensity depend on other factors, as well. One of these factors is the gender difference. Maletić (2002) reports weight difference due to different sex at 60 days to be 91.10 g.

A significant influence of the tested factors has been described for daily liveweight gain which varied for the first period from 2.55 to 4.22 g/day to 9.53 to 13.31 g/day for the second period. The obtained results are close to the values obtained from previous studies. Pullianen (1965) reported liveweight gain for pheasants at 5 to 15 days of age to be 4.8 g/day. Glamočić (1995) studied pheasants in the period from 15 to 42 days of age. That daily liveweight gain ranged in the interval between 7.84 - 10.97 g/day. Bearing in mind that pheasants are not ruminants in their diet is of great importance the composition of present aminoacids compared to the overall protein content (Pack, 1996). Accordingly, pheasants can be successfully grown on a diet with a lower protein content as long as the optimal level of limiting essential aminoacids is achieved.

Feed consumption for unit weight growth significantly depends on the protein level in the diet ($p < 0.01$). At the same time population density did not affect feed conversion ($p > 0.05$). With increasing protein levels in the diet a decreasing trend for feed consumption per unit growth has been described. However, other factors such as the chemical composition of the diet and the metabolic energy value were of great importance for feed consumption. Glamočić (1995) reported that feed consumption for kg growth at different energy levels in the concentrated feed (11.30, 11.72 and 12.97 MJ/kg) was at 15 days of age 4.08, 2.31 and 1.85 kg, respectively. Thereon, up to 42 days of age, the values reached 4.39, 2.73 and 2.50 kg, respectively. In addition, the biological value of proteins is very important for feed conversion, specially regard the content of methionin and lysine (Gonzales *et al.*, 1997).

The tested factors did not have a significant influence on the mortality of pheasants. The explanation partially sits on the fact that mortality depends on a set of environmental factors such as temperature, ventilation, light, hygiene, etc.

According to Jović (1964) the average mortality of pheasants up to the age of 20 days was 7.92%. Braastad (1986) published data which revealed that at 16 weeks of age the average mortality, including chicks that died do to picking; was 2.0 to 8.7%. Popović and Stanković (2009) compared mortality reports from two pheasant farms in Serbia and disclosed data which indicate that mortality of 40 days old chicks was on the first farm 8.33 - 13.39% and on the second farm 3.60 - 4.74%. On comparison with the available literature data the mortality values in the experiment described in this paper can be considered satisfactory.

CONCLUSION

Based upon the obtained results of experimental pheasant growth with two levels of proteins and two population densities can be concluded: feeding pheasants a diet with a high protein content (30% up to 15 days of life and 24% protein content up to 42 days of life) and a lower population density (450 birds/group) resulted in a significantly higher body mass (457.07 g) and improved

daily liveweight gain (4.22 g for the first period and 13.31g for the second), as well as a superior feed conversion ratio.

The influence of protein content on all tested production parameters at both growth stages has shown a high statistical significance ($p < 0.01$).

Population density significantly influenced body mass at both stages of the experiment ($p < 0.01$ and $p < 0.05$) and daily weight gain at the first stage ($p < 0.05$). No interaction between the tested factors was statistically determined.

Mortality varied without a significant influence of the studied factors. Compared to available literature data mortality was at a satisfactory level.

Generally, it can be concluded that adequate dietary protein content level is a key factor for the achievement of high final body mass and hence good quality birds for the repopulation of hunting grounds.

ACKNOWLEDGEMENT:

This investigation was financed by grant TR 20019. We wish to thank the Ministry of Science and Technology, Republic of Serbia for the support.

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UTICAJ NIVOVA PROTEINA U OBROKU NA PROIZVODNE REZULTATE I MORTALITET FAZANČIĆA GAJENIH U KONTROLISANIM USLOVIMA

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SADRŽAJ

U eksperimentu je ispitivan uticaj nivoa proteina u obroku i gustine naseljenosti fazančića u odgajivalištima, do 42. dana starosti, na proizvodne rezultate i procenat mortaliteta.

Eksperiment je postavljen kao dvofaktorijalni ogled (2x2), gde je faktor A bio procenat sirovih proteina u obroku ($A_1 = 26\%$ do kraja 4. nedelje i 20% od kraja 4. do kraja 6. nedelje života; $A_2 = 30\%$ do kraja 4. nedelje i 24% od kraja 4. do kraja 6. nedelje) a faktor B gustina naseljenosti ($B_1 = 450$ i $B_2 = 550$ jedinki po grupi). Ukupan broj životinja u eksperimentu je bio 2000. Merenje mase fazančića vršeno je odmah po rođenju, 15. i 42. dana života. Do 15. dana života fazančići su držani u kavezima a u drugoj fazi gajenja u podnom sistemu sa ispustima.

Najveću telesnu masu izmerenu 42. dana starosti (457,07 g) i najveći dnevni prirast (4,22 g za prvi period odgajivanja i 13,31 g za drugi period) ostvarili su fazančići koji su hranjeni smešom sa većim nivoom proteina (30% u prvoj fazi odnosno 24% u drugoj fazi), kao i pri manjoj gustini naseljenosti (450 jedinki po grupi). Ove razlike su bile signifikantne ($p < 0,01$). U poređenju sa drugim literaturnim podacima, mortalitet fazančića je bio zadovoljavajući (1,27-3,00%) i nije bio pod uticajem ispitivanih faktora. Vrednosti mortaliteta su bile numerički veće u svim tretmanima za period odgajivanja do 15. dana (0,73-2,7%) u odnosu na period od 15. do 42. dana (0,44-1%).

S obzirom na rezultate iz ovog eksperimenta kao i na brojne literaturne podatke, može se zaključiti da je odgovarajući nivo proteina u smeši za odgoj fazanskih pilića ključni faktor za postizanje visokih završnih masa, a samim tim i za dobitjanje kvalitetnog materijala kojim će se naseljavati lovišta.