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RECOMMENDATIONS AND RESULTS OF SUPPLEMENTAL FEEDING OF PHEASANTS DEPENDING ON THE SEASON

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Summary: The quality and quantity of natural food resources and food from agricultural land vary considerably depending on the type of the hunting ground and the season. In order to achieve better body weight of the hunted pheasants, to preserve their number and achieve better reproductive potential of these birds, supplemental feeding is necessary. Previous studies have shown that feeding of pheasants in hunting grounds in all seasons, and especially during the winter, yields positive results. The achieved results, however, are significantly dependent on the degree of anthropogenic activity in the hunting grounds, as well as the amount of natural food. Moreover, nutrition must be adequate not only in terms of the quantity, but also the quality. This means that instead of single feeds (most commonly cereals: wheat, corn, etc.), complete mixtures should be used, which is a costly solution. However, pheasants aged five or more months are increasingly in demand for hunting on the polygons. Nevertheless, hunting in preserved nature and with a diverse wildlife fund will never lose its significance.

Key words: pheasant, feeding, hunting ground, seasons..

INTRODUCTION

The intense hunting pressure on pheasants, as the favorite game species in Serbia, can only be met with artificial reproduction of pheasants and their releasing in the hunting grounds at a certain age. In Serbia, the existing capacities for rearing pheasant chicks largely exceed the needs, as the capacities amount to almost 1,000,000 one-day-old pheasant chicks during the year (Popović et al., 2011a). The technology of rearing pheasants in aviaries has been significantly improved in recent years, so that dozens of pheasant chicks can be obtained from one laying hen (Đorđević et al., 2012c). Nevertheless, the financial expenditures in pheasant rearing are significant and additionally increased by losses after releasing the pheasants in the hunting grounds, due to illness, predators and the lack of food. In recent years, fewer pheasant chicks have been released in the hunting grounds compared to 1990s, due to a more unfavorable financial situation among the users of the hunting grounds. Consequently, the need arises to maximally preserve the number of pheasant chicks brought in the hunting grounds by the hunting season, as well as to increase the rate of natural reproduction of the pheasants.

Although it is considered that the extent of forest cover is one of the best indicators of suitability of hunting grounds for most small game species and all large game species (Popović et al., 2010), it does not apply to pheasants, as these animals require lower altitudes, covered with low vegetation and with abundance of food and water. However, the habitats occupied by pheasants in Serbia today are endangered by various forms of human activities (agriculture, traffic, tourism, hunting, etc.), which requires different measures to be taken by the users of the hunting grounds. One of them is feeding. Due to significant costs of feeding, this measure is often only formally taken, using the cheapest feed and only during the winter (Đorđević et al., 2009b, 2010a). Numerous studies (part of them presented in this paper) show that feeding of pheasants in the hunting grounds throughout the year yields positive results, manifested in the increase in the body weight of the hunted pheasants and the number of these animals.

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FOOD RESOURCES FOR PHEASANTS IN THE HUNTING GROUNDS

The largest areas of the hunting grounds in Serbia (42.9%) are fields and arable land (Popović et al., 2008). These areas are heavily utilized (by mechanization, chemical inputs and melioration), which has adverse effects on the reproduction of the pheasants, their number and the body weight of the hunted pheasants. Kaluzinski (1982) argues that the animals that suffer the most severe damage from agricultural mechanization are pheasants, followed by rabbits and does, especially in the grain and alfalfa fields. The direct influence of human activities leads to destruction of nests, killing young and adult pheasants, while the indirect influence is manifested as disturbing the wildlife resulting in their migration to calmer parts of the hunting grounds. In addition, after the harvest, large areas under monocultures remain virtually without food and shelter for pheasants. Meadows and pastures (18.4% of the area of the hunting grounds) are significantly less utilized, offering thus more natural conditions. Forests and forest land (27.8% of the area of the hunting grounds) are less important as habitats for pheasants.

In different types of the hunting grounds, especially in the areas where human activities are less intensive, the spring and the beginning of the summer are abundant with food of plant and animal origin for pheasants. By feeding on insects and their larvae, pheasants (especially younger categories) can be very useful for humans (Đorđević et al., 2011b, c). By studying the crop content of 672 shot pheasants, Jovanović and Orlić (2004) found that, in adult pheasants, animal feed account for only a very small share of their nutrition: 0.4% (Table 1). According to these authors, in the last few decades, the share of food of animal origin in the daily meals of the pheasants has decreased from 33.5 to 0.4%. This change can be accounted for by great changes in their habitats, caused by various forms of human activities, primarily agricultural works.

The second half of the year brings a deficit in food and even in shelter, which can lead to loss of the body weight and death. This is a particularly great problem for pheasant chicks brought from the aviaries to the hunting grounds. Also, diseases and predators further increase the death rate of the young birds (Popović et al., 2009). On the other hand, when searching for food and water, pheasant can cause certain damage to vegetable crops. The damage caused by the pheasants is evident also in the spring period, when the pheasants feed on the seeds or pull out the emerging crops (Đorđević et al., 2008, 2009a, 2010b).

Table 1. Seasonal composition of feed of adult pheasants (Jovanović and Orlić, 2004)

Season	Green plant feed	Of which		Animal feed
		Generative parts	Vegetative parts	
Spring	99.4	95.6	3.8	0.6
Summer	99.2	91.6	7.6	0.8
Fall	99.8	89.9	9.9	0.2
Winter	99.9	96.9	3.9	0.1
Year	99.6	92.0	7.6	0.4

NUTRIENT REQUIREMENTS OF PHEASANTS

Since pheasants have been reared in aviaries throughout the world for a number of decades or even centuries (in Serbia since the end of 19th century), their nutrient requirements have been thoroughly studied and included in the norms such as INRA, AEC, NRC (Đorđević et al., 2011a). A large number of experiments in the world have studied nutrition of pheasants under controlled conditions, while in our country these studies have been carried out with more modest means (Popović et al., 2011b, 2013; Đorđević et al., 2013, 2015). Apparently, nutrient requirements of pheasants in nature are much different from the requirements of these animals in pens. Due to significantly higher intensity of egg-laying and the length of the egg-laying period, the pheasant hens in pens have higher requirements for energy, proteins and certain minerals (Đorđević et al., 2012b). On the other hand, the activities of pheasants in the pens are certainly less intensive compared to their activities in nature, which affects their overall needs. During the winter period, the parent stock in the pens is fed daily with meals to meet their sustenance needs, and while these meals used to be made of grain foods, today they are most frequently balanced concentrate mixtures. By contrast, pheasants in the wild during the winter period can be without food for days, surviving on their body fat reserves. The state of the body reserves in the autumn is crucial both for the survival and for physical fitness in the spring (Sage et al., 2002), which affects also the efficacy of reproduction (Draycott et al., 1998, Hoodless et al., 2001).

Experiments with feeding of pheasants in nature can never be completely controlled since part of their meals always includes natural foods. The composition of the "natural" portion of the meal affects the results of the experiments, which are often illogical or simply missing. Therefore, recommendations for feeding of pheasants in nature can be wrong. The composition of their natural diet can be partially determined by examining the contents of their crops (Đorđević et al., 2009a). However, these data are also highly disputable, since food is kept in the crop only if the stomach is already full (Popović and Đorđević, 2009). In addition, the nutrition of pheasants in nature is very variable, depending not only on the season, but also on the type of their habitat (Đorđević et al., 2012a). On the other hand, the nutrition of different pheasant categories in pens is strictly controlled and adjusted to their needs (NRC, 1994). Today, the parent stock of pheasants is fed with concentrate mixtures of different composition throughout the whole year. During the first period, the pheasant chicks are intensively fed with concentrate mixtures; however, in the period before being released in the hunting grounds, their nutrition includes also grain and green plant foods, and even food of animal origin (ants, their larvae, etc.), so that the chicks could be adapted to the new surroundings as easily as possible. Modern scientific achievements enabled complete substitution of foods of animal origin by concentrate mixtures, by using synthetic amino acids (Đorđević et al., 2014). However, during the phase of preparing the pheasant chicks to be released in the hunting grounds, their nutrition includes also "natural" foods (grains, green plant food, carrots, etc.), and even the above mentioned food of animal origin. The aim of all these measures is ensure good adaptation and maximum survival of the pheasant chicks in the hunting grounds.

RESULTS OF SUPPLEMENTAL FEEDING OF PHEASANTSIN THE HUNTING GROUNDS

Winter feeding.

Winter is certainly the "most critical" season for survival of pheasants, since low temperatures and snow cover lead to increased energy needs and problems in finding food. Pheasants are extremely resistant birds and they rarely die of starvation. However, in search of food, they more easily become prey of predators (Lanszki, 2005). Therefore, winter feeding of pheasants is the most common form of supplemental nutrition for this game species. The needs of adult birds in cold days are primarily related to the energy needs. The foods most commonly used for feeding are cereal grains, primarily corn, as the most efficient way. Compared to other cereals, corn has the highest percentage of starch and fat, which are good sources of energy, and the lowest percentage of cellulose, which has a depressive effect on digestion. In addition, corn grain is resistant to moisture and potential subsequent microbiological changes, compared to powdered or pelleted foods (Đorđević and Dinić, 2011). In order to achieve satisfactory results of winterfeeding of pheasants, it is necessary to start adapting the pheasants to the feeding sites on time, preferably immediately after the harvest. The choice of the feeding site (a permanent or an improvised one) is very important, as it should provide the birds with good visibility for predators.

Intensive feeding of pheasants in plains should begin in November and last until the end of March, on terrains of medium height it should last from October to the end of March, and on high terrains from October to the end of April. The amount of grain feed depends on the area, temperature, presence and height of the snow cover and the length of feeding. Apart from grain foods, juicy foods (beet, cabbage, Savoy cabbage, Jerusalem artichokes, etc.) can also be used on days without frost. Food is brought to the feeding sites once a day or every other day, preferably in the morning, when pheasants are most active in seeking food. In case of heavy snowfall, the pheasants remain in the vicinity of the feeding site the whole day. The daily amount of grain planned for winterfeeding of pheasants is 40-60 g per bird, while the feeding site (4 × 4 m) is planned for 100 birds. The required quantities of grain feed for winter feeding are given in Table 2 (Hanuš and Fišer, 1983).

Table 2. Amount of food for winter feeding by areas (Hanuš and Fišer, 1983)

Type of feed	No. of feeding days	Amount of feed for 100 pheasants, kg		
		Minimum	Average	Optimum
Concentrated	150	600	750	900
	180	720	900	1080
	210	840	1050	1260
Juicy	150	750	900	975
	180	900	1080	1170
	210	1050	12600	1365

Spring feeding.

The reproduction period of pheasants, as of most other wild animals, coincides with the maximum development of vegetation and the abundance of food of both plant and animal origin. Consequently, in some types of the hunting grounds there are no results of supplemental feeding of pheasants, while in others there are certain improvements. For example, Draycott et al. (1998) found that during the spring feeding with wheat grains, the fat reserves in females in April were at the similar level as in February (76.9 ± 8 g), while the fat reserves in females from the non-feeding area were two times lower (34.7 ± 6.9 g). This means that the non-feeding pheasant hens had a worse condition for the egg-laying period. In another experiment for the period 1997-2000, Draycott et al. (2005) carried out feeding of pheasants with wheat grains from mid-February to mid-May (Table 3). During the inspection in April, the authors found a higher density of males on the territory with supplemental food (22.6 ± 1.5 birds / km2), compared to the control (14.8 ± 1.2 birds / km2; P <0.001), as well as a higher density of females (treatment = 40.6 ± 5.8 birds / km2, control = 24.1 ± 3.8 birds / km2; P <0.001). During the inspection in September, there were no statistically significant differences in the number of adult pheasants on the territory with or without supplemental food, but there was a statistical difference in the number of young birds (treatment = 10.8 ± 1.5 birds / km2, control = 5.6 ± 1.0 birds / km2; P = 0.02).

However, in some other experiments, there were no results of feeding. For example, Hoodles et al. (1999) in England examined the effect of the spring feeding of pheasants (also with wheat grains) on reproductive results. In the experiment, the authors used six plots, each of the area of 1 km2, which were 350 m apart. On three plots, 25 liter feeders were used for feeding pheasants with wheat. During the experiment, the authors found a significant increase in the number of territories controlled by the cocks on the plots with feeding compared to the non-feeding plots, while at the same time the size of the harems was significantly reduced. However, the feeding did not lead to an earlier nesting, nor to an increase in the nest size, but the pheasant hens with destroyed nests nested again more quickly. Another recent experiment has also denied the importance of the spring feeding of pheasants in the hunting grounds. Lu and Zheng (2003) used barley for feeding the endangered pheasant species *Crossoptilon harmani* i in Tibet. The authors did not find significant differences in the number of eggs per female (one nest per female, on average for both groups 7.4 eggs per nest, i.e., 4-11). Lu and Zheng (2003) explain these results by the possibility that birds without feeding compensated for the deficit in nutrients by spending more time searching for food.

Table 3. Table 1. Mean (± SE) breeding and post-breeding densities (birds/km2) of released pheasants on seven private hunting estates in Britain in April and September 1997-2000 in relation to supplementary feeding (Treatment = with feeding, Control = without feeding). Draycott et al. (2005)

Table 3. Mean (± SE) breeding and post-breeding densities (birds/km^2) of released pheasants on seven private hunting estates in Britain in April and September 1997-2000 in relation to supplementary feeding (Treatment = with feeding, Control = without feeding). Draycott et al. (2005)

					Feeding		Estate	
Birds/km^2		N	$\bar{x}$	SE	$F_{1,14}$	P	$F_{6,14}$	P
Breeding densities								
Territorial males	Treatment	20	22.6	1.5	19.98	<0.001	26.88	<0.001
	Control	20	14.8	1.2				
Non-territorial males	Treatment	20	8.3	1.2	0.001	0.98	14.15	<0.001
	Control	20	8,3	1.2				
Females	Treatment	20	40,6	5.8	18.38	<0.001	35.2	<0.001
	Control	20	24,1	3.8				
Post-breeding densities								
Males	Treatment	19	11.1	1.6	1.65	0.22	2.13	0.12
	Control	19	8.3	1.3				
Females	Treatment	19	6.4	1.1	0,05	0.83	1.40	0.29
	Control	19	6.8	1.2				
Young	Treatment	19	10.8	1.5	6.62	0.02	3.05	0.05
	Control	19	5.6	1.1				

The lack of results in the experiment by Hoodles et al. (1999) can be accounted for by the abundance of natural foods, by which the pheasants without feeding "compensated" for the difference in the necessary nutrients. However, this is possible only in preserved habitats, with abundance and diversity of natural food of plant and animal origin. Draycott et al. (2002) claim that chemical inputs and mechanization in agriculture have drastically reduced the choice of natural foods, because the massive use of insecticides has led to reduction of protein foods of animal origin during the nesting season and nourishing of young pheasants, while modern mechanization reduced spreading of

grains and seeds during threshing and sowing, directly increased the mortality of pheasants and destruction of their nests, and led to migrations of the pheasants. Another explanation is inadequate chemical composition of the food used in the described feeding experiments. Namely, wheat and barley are typical energy nutrients, with a small amount of protein of low biological value, a small amount of calcium and an inadequate calcium-phosphorus ratio (Đorđević and Dinić, 2011). According to Wise (1994), positive results of supplemental feeding of pheasant hens during the reproductive season can only be achieved by using well-balanced meals (instead of single feeds such as wheat), as well as an adequate source of calcium. However, the costs of such feeding far outweigh the achieved positive results. In addition, this author suggests that feeders should have better positioning (one feeder at most on the territory of a male – cock), which would reduce the presence of predators and the losses of these birds and eggs. In any case, it can be concluded that the spring feeding of pheasant should be carried out in accordance with the situation in the hunting ground. If the habitat is more preserved and with less human activity, supplemental nutrition is of minor importance. Additionally, it is necessary to control the number of predators and implement the procedures of environmental protection.

Summer feeding.

Supplemental nutrition is a highly important or even a necessary measure for pheasant chicks released in the hunting ground during the summer. These are young birds that are not yet experienced in finding food, water and shelter. Besides, the summer is also the period when the natural food is running out because of the droughts. Harvesting and land cultivation is in progress on arable land, resulting in disappearance of both food and shelter. Ristić et al. (1995) cite the results of a study from Ireland in which 5-week-old pheasant chicks were released, and according to these results, 69% of young birds die or disappear until the age of 12 weeks. Therefore, it is very important to continue the feeding for some time after releasing young pheasants. According to Popović and Đorđević (2009), 3-4 kg of grain foods should be provided per 100 young birds on a daily basis during this critical period, as well as water, as deficit of water can be a particularly big problem. The nutrition consisting of pelleted concentrate mixtures is certainly a better option, but also a more expensive one. Sage et al. (2002) state that the practice in England is that young pheasants are fed after releasing, and that it is in the interest of the hunting ground manager to switch to grain foods as soon as possible, as it is a cheaper solution. Accordingly, these authors examined the effect of feeding of pheasants at the age of 6-16 weeks with a concentrate mixture containing 20% protein, 4% fat (oil), 4.5% cellulose and 6% ash. On the other hand, the control groups of pheasants after the age of 10weeks were provided only with wheat grains, containing about 10% of crude protein. In addition to these meals, the pheasants had unlimited availability of natural foods of plant and animal origin. Nevertheless, the birds from the control groups could not compensate for the deficit of certain nutrients. Therefore, the authors found significant differences in the body weight and the amount of cloacal fat in 100 shot birds (50 males and 50 females) at the age of 22-24 weeks (Table 4).

Table 4. Means of body, muscle and fat mass and tarsal length of pheasants per pen, by sex, for each treatment group1,2 (Sage et al., 2002)

Parameters	Diet protein	Male(n=50)	Female (n=50)	Difference between diets, accounting for sex
Body mass (g)	20%	1336.7±27.1	1034.8±27.1	$F_{1,8} = 4.41$, $P<0.1$
	10%	1317.7±33.1	980.2±33.1	
Pectoral muscle mass (g)	20%	201.7±3.9	153.3±3.9	$F_{1,8} = 0.25$, $P>0.1$
	10%	203.8±4.8	152.9±4.8	
Cloacal fat mass (g)	20%	5.58±1.63	13.09±1.63	$F_{1,8} = 6.25$, $P<0.05$
	10%	4.53±2.00	8.58±2.00	
Tarsal length (mm)	20%	73.6±0.4	66.3±0.4	$F_{1,8} = 0.20$, $P>0.1$
	10%	74.0±0.5	66.4±0.5	

[1]From subsample of 100 birds, 22 to 24 weeks old, that were shot and then examined post-mortem.

[2]Mean values and standard errors are based on pen means (n=6 for high protein diet; n=4 for low protein diet) weighted for sample size. Analyses of covariance between treatment groups account for sex and pen and include initial body mass as a covariate. Origin and interactions were not significant at P>0.05 in all cases

CONCLUSION

Previous research has shown that feeding of pheasants in the hunting ground, at all seasons, and especially during the winter, yields positive results. However, the achieved results significantly dependent on the degree of anthropogenic

activity in the hunting grounds, as well as the amount of natural foods. Chemical inputs and mechanization of agriculture have particularly affected the natural sources of food for pheasants. Therefore, supplemental feeding of pheasants in the hunting grounds should be carried out in accordance with the situation in these hunting grounds. If the habitat is more preserved and with less human activity, feeding is of minor importance. In addition to this measure, it is necessary to control the number of predators and the procedures of environmental protection. Due to the high price of pheasant rearing in aviaries, pheasants aged five and more months are increasingly in demand for hunting on the polygons. Nevertheless, hunting in preserved nature and with a diverse wildlife fund will never lose its importance.

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PREPORUKE I REZULTATI DODATNE ISHRANA FAZANA U ZAVISNOSTI OD GODIŠNJEG DOBA

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Rezime: Kvalitet i kvantitet prirodnih resursa hrane, kao i sa poljoprivrednih površina, značajno se razlikuju zavisno od tipa lovišta i godišnjeg doba. U cilju postizanja bolje odstrelne mase, očuvanja brojnosti i postizanja boljeg reproduktivnog potencijala fazana, neophodno je prihranjivanje. Dosadašnja istraživanja ukazuju da pihranjivanje fazana u lovištu, u svim godišnjim dobima, a naročito u toku zime, daje pozitivne rezultate. Međutim, postignuti rezultati značajno zavise od stepena antropogene delatnosti u lovištima, kao i od količine prirodne hrane. Pri tome, prihranjivanje mora biti adekvatno ne samo u kvantitativnom, već i u kvalitativnom smislu. Zbog toga umesto pojedinačnih hraniva (najčešće žita: pšenice, kukuruza...) treba koristiti kompletne smeše, što je skupo rešenje. Umesto toga, sve se više traže fazani starosti pet ili više meseci, za lov na poligonima. Ipak, lov u očuvanoj prirodi i sa raznovrsnim fondom divljači nikada neće izgubiti na značaju.

Ključne reči: fazan, dodatna ishrana, lovište, godišnja doba.

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