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Feeding Efficiency of Dry Beet Pulp to Broiler Chickens

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***Abstract*—The article presents the results of the usage efficiency of broilers of non-conventional raw materials of vegetable dry beet pulp, which has a positive impact on the physiological characteristics of poultry and quality indicators of meat. The research was carried out at the premises of the educational and scientific poultry farm of Belgorod State Agricultural University. For the experiment, 140 daily chickens were selected and four groups (peer groups) were formed: one control group and 3 experimental groups of 35 heads each. Duration of the scientific and economic experiment – 41 days. The control group received the basic diet (BD). Chickens of all the experimental groups received the basic diet from 1 to 20 days. In 21-41 days, chickens of the 1st experimental group were fed 98% BD and 2% of the dry pulp, 2nd group – 96% BD and 4% of dry pulp, while 3d experimental group – 95% BD and 5% of dry pulp. As a result of the research, it was found that the use of dry beet pulp (replacement of 4% BD) in the diets of broiler chickens has a positive impact on their productivity and the quality of meat products. When it is included in the diet, the feed costs per unit of output are reduced. By replacing the basic diet with dry pulp, the authors significantly reduce the cost of feed, which leads to an increase in profitability by 4.7%.**

Keywords—Broiler chickens, dry beet pulp, live weight, efficiency, meat quality

I. INTRODUCTION

Poultry production in most countries is still the largest source of complete animal protein production [1-4]. Poultry farming is an intensively developing and highly productive branch of animal husbandry, which provides the population with dietary foodstuffs and the industry with raw materials. Science and practice have proved that poultry farming has the most favorable chances for rapid development and is able to make a significant contribution to the food security of the country in the next decade [2, 5-7]. Industrial poultry farming of Russia makes a significant contribution to the country's food security as the main producer of high-quality animal protein, the share of which in the daily diet of Russians reaches 40% due to the consumption of dietary eggs and poultry [8, 9].

Growing chickens for meat are the main link in the broiler production chain. Broiler chicken meat accounts for about 85% of the world's poultry production [3, 6, 10-12]. In the production of poultry products, a significant share of the cost is occupied by feed, however, one can barely reduce this figure without losing productivity [13- 15].

Currently, the main constraint for further development of poultry farming is limited feed resources. The cost of feed in the cost of poultry production is almost 60%. In this connection, an important direction of research in the field of poultry feeding is the search for cheaper non-traditional and affordable feed means, which are close in their biological value to traditional ones and allow reducing the share of cereals in diets [16-19].

One of such feed is dry beet pulp. The dry pulp is a waste of sugar beet production, belongs to the concentrated feed. High-temperature drying of sugar beet increases the

concentration of nutrients by 4-5 times compared to the initial raw materials. One kilogram of dry pulp contains 9.7-11.2 MJ of metabolic energy and 102.7 g of protein. Rich in nitrogen-free extractive substances (NFES) (70.6 %), relatively high in calcium, sodium, magnesium and trace elements. The digestibility of organic matter is high (up to 85%) not only in cattle, but also in pigs due to the fact that there is almost no lignin in the fiber composition. Pulp proteins are relatively rich in lysine (0.61%), arginine, leucine, phenylalanine, threonine and valine, but poor in methionine and cystine. It contains a lot of calcium, potassium, sodium, magnesium, iron, manganese, copper and cobalt, but little phosphorus and zinc (compared to grain fodder). One kilogram of dry pulp is produced from 16 kilograms of fresh pulp. Dried beet pulp gives a pleasant sweet taste to combined feed, which promotes the intensive consumption of animals [2, 7, 20, 21].

II. EXPERIMENTAL

The experimental part of the research on the efficiency of dry pulp utilization in the composition of diets for broiler chickens for economically useful and physiological parameters of poultry was carried out in the conditions of the educational and scientific poultry factory of Belgorod State Agricultural University.

The object of research were broiler chickens of HubbardF-15 cross.

140 daily chickens were selected for the experiment with four groups (peer groups) were formed, one control group and 3 experimental groups of 35 heads each. Duration of the scientific and economic experiment – 41 days.

The chickens were kept on the floor during the experiment. Room temperature, ventilation and lighting, feeding and drinking fronts met the technological requirements. Feeding and keeping conditions for the chickens were the same, and the difference was in the composition of the diets.

Feeding features of broiler chickens are as follows: the control group received a basic diet (BD), which included

- PK-5-1 (0-10 days pre-starting period);
- PK-5-2 (11-20 days starting period);
- PK-5 (21-33 days growth period);
- PK-6 (34-41 days finishing period).

The effectiveness of feeding different doses of dry pulp was studied in three groups of broiler chickens. In the test groups, some of the complete combined feed was replaced by dry beet pulp. The experimental scheme is shown in Table I.

The pre-starter feed was given to the bird in the form of coarse grains. Then the granules were used. An excess dusty fraction in granulated feed reduces its edibility. Recipes for the growth and finishing periods changed as a result of the inclusion of different amounts of dry beet pulp in the diets. After analyzing the structure, composition and nutritive value of diets, it can be seen that all the recipes of the experimental groups contain balanced content of basic nutrients and bioactive substances and comply with the rules of poultry feeding.

TABLE I. TEST SCHEME

Growing periods	Groups			
	Control	***1***	***2***	***3***
I	PK-5-1	PK-5-1	PK-5-1	PK-5-1
II	PK-5-2	PK-5-2	PK-5-2	PK-5-2
III	PK-5	98% PK-5+2% dry pulp	96% PK-5+4% dry pulp	95% PK-5+5% dry pulp
IV	PK-6	98% PK-6+2% dry pulp	96% PK-6+4% dry pulp	95% PK-6+5% dry pulp

III. RESULTS AND DISCUSSION

In the course of the experiment, the authors took into account the dynamics of live weight, feed conversion, hematological blood parameters.

Live weight is an indicator of the growth and development of poultry, reflecting the impact of feeding and keeping conditions of the broiler. Live weight determines within the species, breed morphological features of the constitution, character and degree of intensity of physiological processes. HubbardF-15 broiler chickens have a potential (genetically embedded in the body) to accelerate the growth rate of live weight from 60 to 130 g per day and, as a consequence, are characterized by high rates of live weight. It is necessary to create favorable conditions for the manifestation of genetic potential to the fullest extent and to achieve high levels of productivity, in particular of living mass, by increasing muscle mass.

During the I (0-10 days) and II (11-20 days) growing seasons, the live weight was controlled by changing diets, and every 5 days during the III and IV periods.

The analysis of chicken growth dynamics during dry pulp feeding revealed changes in chicken growth dynamics in different age periods. With the almost equal live weight in the first day and at the end of the I and II growing seasons the live weight of the chickens of the first and second experimental groups was higher by the killing age – 41 days in comparison with the control group (Table II).

TABLE II. LIVE WEIGHT OF BROILER CHICKENS, G

Age, day	Groups			
	Control	***1***	***2***	***3***
1	45.1±0.4	44.8±0.3	44.9±0.4	45.0±0.4
10	239.0±4.9	237.1±3.7	238.0±4.3	239.1±4.5
20	715.4±12.3	711.2±12.9	716.8±11.8	714.1±17.4
25	1098.6±17.5	1082.6±21.8	1094.4±17.0	1058.0±21.6
30	1439.4±26.0	1433.1±29.2	1430.6±23.7	1380.9±26.3
35	1850.3±29.4	1860.9±33.8	1869.4±29.0	1775.1±25.8
41	2287.4±38.1	2323.1±41.4	2334.1±34.8	2203.1±32.8
Average daily increase, g	54.7	55.6	55.8	52.6

Thus, the maximum difference in the live weight of broiler chickens before changing the standard diets to experimental diets (at 20 days of age) was 0.8%.

By the age of 25 days, chickens with the diet of 2 and 4% of dry pulp lagged behind in growth insignificantly in comparison with the control group – by 1.5 and 0.4%, respectively. Broilers in the third experimental group, with 5% pulp, were 4.0% behind. At the age of 30 days, the gap in the first and second experimental groups decreased to 0.4 and 0.6%. The bird of the third experimental group was 4.1% behind the control group. During 41 days the absolute increase in live weight of broilers of the 2 experimental groups was 2334.1 or by 2% more than in the control group. The lowest figure was recorded in the group where 5% of the pulp was fed, which is 3.8% lower than in the control group.

In broiler production, it is important to take into account the amount of feed consumed in the production of 1 kg of live weight. Payment for live weight forage is directly related to the farm profitability, the efficiency of raising broiler chickens.

On average, this indicator in the experimental group 2, where 4% of the pulp was fed, was 1.64 kg of combined feed, which is 1.8% less than in the control group.

The methods that allow giving an objective assessment of the physiological state of metabolic processes in animals include the study of the blood state. It is directly involved in specific and non-specific reactions of the body, influencing its resistance and reactivity, while sensitive to the various exposed effects.

Research results indicate that the hematological indices of all groups were within the limits of permissible fluctuations for healthy agricultural poultry. Thus, in the first experimental group, an increase of RBC by 13.6% ($p \geq 0.95$) and Hb by 1.2% was noted in comparison with the control group. In the second experimental group, there was also an increase in RBC content by 28.5% ($p \geq 0.99$) and Hb content by 2.0%. In the third experimental group there is more RBC than in the control group by 5.0%, by 0.9% in Hb. It testifies to the strengthening of the experimental groups' blood respiratory function, to the better supply of oxygen and to more intensive redox processes, as a consequence activation of metabolic processes. In the 1 and 3 experimental groups where the pulp was fed, the content of immunoglobulins (Ig) exceeded the control group by 15 and 33%. In the group where 5% of the pulp was fed, the difference was significant.

Based on the results of scientific and economic experience, a production audit was carried out. Four-phase feeding was used to raise broiler chickens. The first group was fed without dry pulp, while the second group was fed with 4% pulp.

Daily records were kept of the physiological condition of the test bird. In all the experimental groups, all the physiological and livestock indices taken into account were within the norms corresponding to the data of the studied cross.

The live weight of the chickens in the test group is 0.5% higher than in the control group. Feed costs in the experimental group are lower than in the control group by 0.6%.

TABLE 3. RESULTS OF THE PRODUCTION INSPECTION

Indicators	**Groups**	
	Control	***Test***
Livestock, heads	1000	1000
Mortality, %	96.2	96.8
Average live weight of 1 head, kg	2.082	2.093
Total costs	73439.7	71423.5
Total revenue, RUB	90129.6	90996.7
Profit from sale of meat, RUB	16689.9	19573.2
Profitability level, %	22.7	27.4

Based on the results of economic indicators during the production inspection it is clear that as a result of the decrease in the cost of combined feed, which includes dry pulp, the experimental group has a level of profitability higher than the control group by 4.7%.

IV. CONCLUSION

After analyzing the feed edibility, poultry safety, dynamics of live weight, feed conversion, digestibility of nutrients, the authors came to a decision that the best in terms of productivity was 2 experimental group, where 4% of the main diet was replaced with dry pulp.

During 41 days the absolute increase in live weight of broilers of the 2 experimental groups was 2334.1 or by 2% more than in the control group. The lowest figure was recorded in the group where 5% of the pulp was fed, which is 3.8% lower than in the control group.

Feed costs per 1 kg of live weight gain in all groups are within the limits stipulated by the livestock norms for the given poultry cross. On average, this indicator in the chickens of the 2nd experimental group, where 4% of pulp was fed, was 1.64 kg of combined feed, which is 1.8% less than in the analogs of the control group.

After analyzing the blood hematological status, it can be concluded that feeding dry pulp to broiler chickens has a positive impact on the improvement of the overall level of metabolism, which ultimately provides a higher level of implementation of the genetic potential of broilers.

As a result of the research, it was found that the use of dry beet pulp (replacement of 4% BD) in the diets of broiler chickens has a positive impact on their productivity and the quality of meat products. When it is included in the diet, the feed costs per unit of output are reduced. By replacing the basic diet with dry pulp, the cost of feed is reducing significantly, which leads to an increase in profitability by 4.7%.

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