

# CHICKPEA AND PROSPECTS OF ITS USE IN FEEDING FARM ANIMALS AND POULTRY

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Received: 03.08.18, Revised:03.09.18, Accepted: 03.09.18

## ABSTRACT

At the present time, the problem of searching for alternative sources of protein is urgent, since its deficiency is becoming more important at livestock and poultry enterprises in the Volgograd Region. In this regard, comprehensive studies on the possibility of using substandard chickpea of Privo-I variety of Volgograd selection in the diets of cattle and agricultural poultry were carried out. The study of the amino acid composition of different varieties of chickpea in Volgograd revealed the superiority of Privo-I variety over Krasnokutskiy-36 and Volgogradskiy-10: in terms of methionine – by 0.12% and 0.09%, lysine – by 0.34% and 0.22%, tryptophan – by 0.06% and 0.05%, respectively. For such amino acids as threonine, arginine, isoleucine, leucine, valine, histidine, there was a similar trend. In this regard, it was decided to further study the chickpea of Privo-I variety. The content of crude protein in chickpea seeds is 28.5%, raw fat – 5.2%. It was also found that, in regard to mineral substances, chickpea seeds were leading in comparison with sunflower oil cake: in the content of calcium – by 0.13 g, potassium – by 0.18 g, sodium – by 0.38 g, iron – by 45.0 mg, manganese – by 2.04 mg, and cobalt – by 0.76 mg. The experiment under the conditions of ZAO "Agrofirma "Vostok" established a positive effect of partial or complete replacement of sunflower oil cake with chickpea in cows' diets. At the same time, there was an increase in daily average milk yield by 3.06-7.57%, as well as in some quality indicators of milk: fat – by 0.04-0.07%, protein – by 0.03-0.07%, dry matter – by 0.43-1.08%, nonfat milk solids – by 0.69-1.74%. The use of chickpea in calf feeding resulted in an increase in the intensity of their growth; the average daily growth was higher by 2.93-3.98%. Introduction of the Privo-I chickpea to the diet of rearing bull-calves contributed to obtaining a larger volume of ejaculate with an increase in the sperm concentration of 1 ml to 0.11 billion. Partial or complete replacement of sunflower oil cake with chickpea in combined fodder for poultry resulted in an increase in the live weight of broiler chickens at slaughter by 5.59-6.77%, egg production of laying hens by 3.05-4.69%. Based on the research, it is possible to recommend the introduction of chickpea in diets of cattle and poultry in order to increase their productive qualities.

**Keywords:** chickpea, Privo-I, productivity, milk, meat, egg, sperm production, growth.

## INTRODUCTION

World experience of successful livestock production shows the need to solve the fodder problem. The genetic potential of animals' productivity can be implemented only with complete diet<sup>1</sup>. When organizing the fodder base, special attention should be paid to improving the quality of fodder and, first of all, increasing the protein and essential amino acids in them<sup>2</sup>. Providing animals with protein in accordance with the standards is an important task in successful development of livestock production; it is necessary to search for all the reserves to increase it and use it rationally in animal diets<sup>3, 4</sup>. An important reserve for increasing protein production is legumes, such as peas, chickpeas, fodder beans and others. A legume crop called chickpea can be used as a product that enriches diet with necessary protein. In addition, it is a source of protein, dietary fiber, minerals (especially

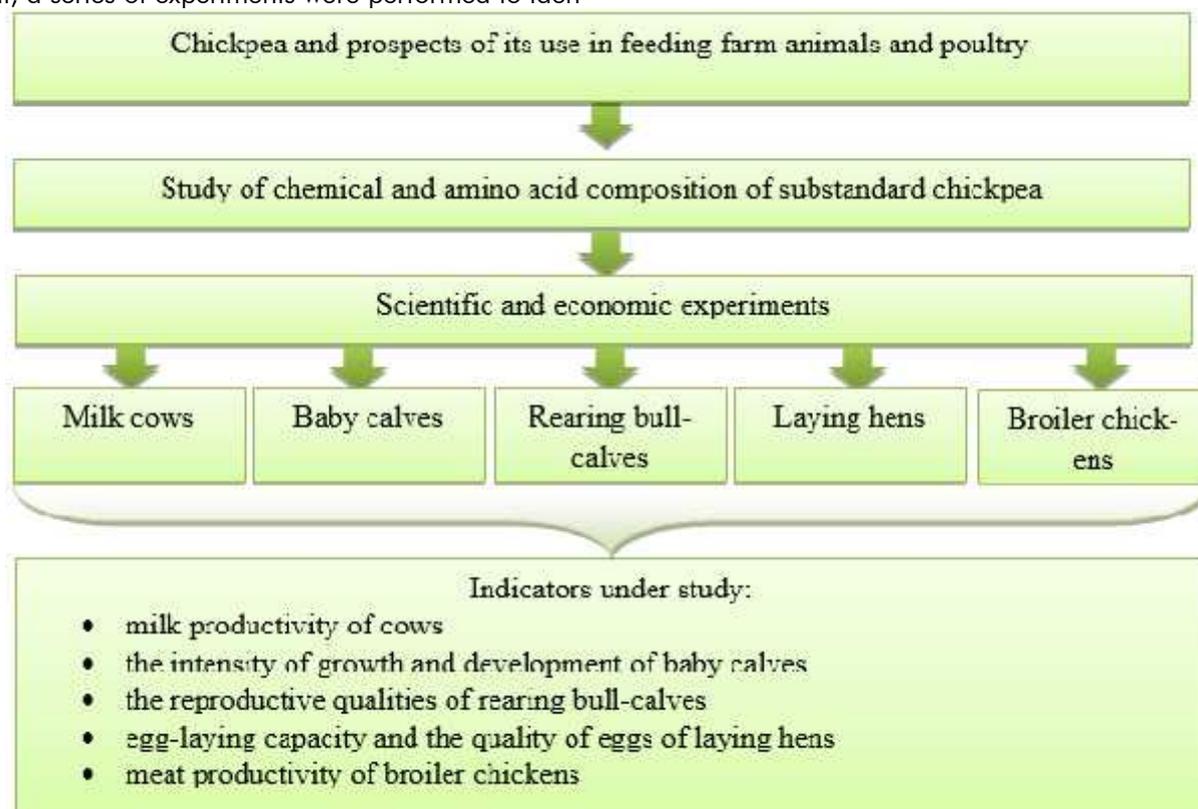
potassium, magnesium, iron), and folic acid. This type of raw materials, in addition to the uniqueness of the chemical composition, is characterized by availability of a sufficient raw material base in the Volgograd Region. Chickpea is considered to be the most promising grain legume crop in the arid regions of the Lower Volga Region<sup>5</sup>. This is due to such economic and useful features as high drought tolerance and processability, low demand for soils and the ability to fix atmospheric nitrogen with nodule bacteria, resistance to pests. The healing properties of chickpea have been known for a long time<sup>6, 7</sup>. Optimization of feeding in obtaining environmentally friendly products of livestock and poultry is of particular relevance and practical importance, namely, the use of chickpea of Volgograd selection in various dosages in the feeding of cattle and poultry, which makes it possible to increase natural resis-

tance, reduce the negative impact of man-made and anthropogenic factors, and ensure the implementation of the genetic potential for the growth, development and productivity of animals and poultry.

### Materials And Methods

Prior to carrying out the scientific and economic experiments on the study of the efficiency of the substandard chickpea use, studies were carried out using an infrared analyzer manufactured by FOSS NIR Systems 5000 to determine the content of essential amino acids in various types of raw materials: sunflower oil cake (7 samples) and chickpea: Privo-1 variety (11 samples); Krasnokutskiy-36 variety (9 samples) and Volgogradskiy-10 variety (10 samples). After that, a series of experiments were performed to iden-

tify the effectiveness of using the Privo-1 substandard chickpea in the diets of cattle and poultry of different sex and age. Research was conducted at livestock and poultry enterprises of the Volgograd region: ZAO "Agrofirma "Vostok" in the Nikolayevsky District, breeding farm SP "Krasny Oktyabr" in the Pallasovsky District, ZAO "Poultry farm "Krasnodonskaya" in the Ilovinsky District (Fig. 1). In the course of scientific and economic experiments, the milk productivity of cows, the intensity of growth and development of baby calves, the reproductive qualities of rearing bull-calves, the meat productivity of broiler chickens, and the egg-laying capacity and the quality of eggs of laying hens were taken into account.



**Fig. 1: General Scheme Of Research**

### Results

Amino acids are essential for cellular, carbohydrate and lipid metabolism, for the synthesis of tissue proteins and many important compounds such as hormones, hemoglobin, vitamins, etc., and also as a metabolic energy source. More than 100 different amino acids have been isolated from biological materials, but only 25 of them are usually present in proteins. Individual amino acids are characterized by the presence of an acidic carboxyl group (-COOH) and a basic nitrogen-containing group (usually the amino group - NH<sub>2</sub>). Due to the presence of both the acidic and the basic group, the amino acids are amphoteric (that is, both acidic and basic properties manifest themselves) and, therefore, act as buffers, resisting a change in pH<sup>8</sup>. As a result of the studies, it has been

established that one of the main requirements for balanced feeding of farm animals and poultry is the evaluation of quality of raw materials for the production of mixed fodder in terms of the amino acid composition, since, on the one hand, the deficiency of mixed fodders in terms of the amino acid composition leads to a decrease in productivity, excess consumption of fodder, i.e. to an increase in the price of fodder, on the other hand, excess of amino acids leads to excess consumption of high-quality nutrition components<sup>9, 10</sup>. In this connection, studies were carried out to determine the content of amino acids in sunflower oil cake traditionally used in mixed fod-

ders, as well as in the substandard chickpea of Volgograd selection of various varieties (Table 1).

**Table 1: Amino Acid Composition Of Fodder, %**

Indicator	Sunflower oil cake	Chickpea		
		Privo-1	Krasnokutskiy-36	Volgogradskiy-10
Methionine	0.79	0.50	0.38	0.41
Methionine + cystine	1.33	0.74	0.62	0.70
Lysine	1.17	1.78	1.44	1.56
Threonine	1.28	1.35	1.28	1.33
Tryptophan	0.49	0.26	0.20	0.21
Arginine	2.77	2.71	2.53	2.64
Isoleucine	1.40	2.20	1.30	1.32
Leucine	2.19	2.41	1.90	1.96
Valine	1.71	1.42	1.20	1.21
Histidine	0.78	0.67	0.62	0.65
Phenylalanine	1.59	1.23	1.14	1.19

The content of methionine in the sunflower oil cake was 0.79%, which was higher in comparison with different chickpea varieties by 0.29%, 0.41%, 0.38%, respectively, in terms of methionine + cystine, a similar pattern was observed and the difference in favor of oil cake was 0.59%, 0.71%, 0.63%, respectively, in the content of tryptophan – by 0.23%, 0.29%, 0.28%, in the content of arginine – by 0.06%, 0.24%, 0.13%, in the content of valine – by 0.29%, 0.51%, 0.50%, in the content of histidine – by 0.11%, 0.16%, 0.13%, in the content of phenylalanine – by 0.36%, 0.45%, 0.40%, respectively. However, in terms of the content of such amino acids as lysine, threonine, isoleucine, leucine, the leading position was occupied by the Privo-1 chickpea in comparison with oil cake, as well as other varieties of chickpea: Krasnokutskiy-36 and Volgogradskiy-10. Before carrying out scientific and economic experiments, the authors also studied the chemical composition of the sunflower oil cake and substandard chickpea of Privo-1 variety. The chemical analysis data indicated that the moisture content of sunflower oil cake was 10.0%, and that of chickpea was 14.0%. The content of raw protein in chickpea was less by 3.0% than in sunflower oil cake. The content of raw fat in sunflower oil cake was at the level of 6.1%, which was more by 0.9% than in chickpea. The content of NFE (nitrogen-free extractives) in chickpea was higher by 12.10% compared to sunflower oil cake. Chickpea seeds are high in mineral substances and vitamins. Nut is a good source of pyridoxine, pantothenic acid and choline. The chickpea seeds under study exceeded sunflower cake in the content of the following vitamins: vitamin A – by 1.9 IU, vitamin B<sub>2</sub> – by 2.0 mg, vitamin B<sub>3</sub> – by 0.5 mg, vitamin B<sub>6</sub> – by 1.4 mg, vitamin PP – by 2.0 mg. When comparing the content of macro- and microelements, it was determined that chickpea was leading by the following indices: in the content of calcium – by 0.13 g, potassium – by 0.18 g, sodium – by 0.38 g, iron – by 45.0 mg, manganese – by 2.04 mg, and cobalt – by 0.76 mg. The content of

such elements as magnesium, chlorine, zinc, iodine was almost at the same level. On the basis of the conducted studies on the chemical and amino acid composition, it was decided to study the efficiency of using substandard chickpea of Privo-1 variety in diets of cattle and poultry partially or completely in place of sunflower oil cake. To study the milk production of cows, as well as the intensity of growth and development of baby calves when using unconventional fodder, chickpea of Privo-1 variety in diets, scientific and economic experiments on animals were conducted at ZAO "Agrofirma "Vostok" in the Nikolayevsky District, Volgograd Region. During the studies, the fodders traditionally used in the farm were introduced to the diet of the control group cows. In the diet of animals of the 1st experimental group, sunflower oil cake was replaced by 50% with substandard chickpea, in the 2nd experimental group – by 75%, in the 3rd experimental group – by 100%. When carrying out the experiment on calves, a similar scheme of replacing the oil cake with chickpea was used: in the 1st experimental group – by 50%, in the 2nd experimental group – by 100%. One of the factors that make it possible to assess the balance and usefulness of cow diet during the experimental period, as well as the productive effect of fodder, is milk productivity (Table 2)<sup>11</sup>. In the course of the experiment, the positive effect of chickpea on milk productivity and the quality of milk was revealed. Thus, an increase in the average daily milk yield in the cows of the experimental groups in comparison with the control group was 5.3%, 7.57%, 3.06%, respectively. At the same time, some quality indicators improved. The milk of the experimental cows did not differ significantly in the content of fat and protein; the difference in favor of the animals of the experimental groups by these parameters was 0.04%, 0.07%, 0.05% and 0.03%, 0.07%, 0.04% respectively. The use of substandard chickpea of the Volgograd selection promoted an increase in the amount of dry matter and nonfat milk solids in the milk composition by 0.43%, 1.08%, 0.65% and 0.69%, 1.74%, 1.04%

compared to the control respectively. To control the growth of the experimental calves, they were weighed monthly in the morning hours before

feeding<sup>12</sup>. The dynamics of the calves' growth are presented in Table 3.

**Table 2: Milk Productivity For The Main Period Of The Experiment (M ± M)**

Indicator	Group			
	control	1st experimental	2nd experimental	3rd experimental
Milky yield for the main period of the experiment, kg	3,954.5±95.3	4,170.1±89.4	4,252.6±87.1	4,197.1±88.5
Average daily milk yield, kg	26.4±1.78	27.8±1.85	28.4±1.67	28.0±1.92
Mass fraction of fat,%	4.21±0.11	4.25±0.13	4.28±0.08	4.26±0.09
Mass fraction of protein,%	3.28±0.08	3.31±0.08	3.35±0.06	3.32±0.05
Dry matter,%	12.82±0.19	12.92±0.21	13.04±0.15	12.96±0.22
Nonfat milk solids, %	8.61±0.09	8.67±0.08	8.76±0.06	8.70±0.07
Lactose,%	4.61±0.10	4.63±0.09	4.66±0.10	4.64±0.08
Ash,%	0.72±0.01	0.73±0.01	0.75±0.01	0.74±0.01
Calcium,%	0.126±0.001	0.130±0.002	0.132±0.001*	0.133±0.001*
Phosphorus,%	0.096±0.001	0.097±0.002	0.100±0.001	0.099±0.001
Density, A°	29.2±0.32	29.4±0.41	29.5±0.39	29.4±0.43
Acidity, °T	17.0±0.05	17.2±0.06	17.1±0.07	17.1±0.05

**Table 3: Dynamics Of Live Weight Of The Experimental Calves**

Indicator	Group		
	control	1st experimental	2nd experimental
Live weight at the start of the experiment, kg	47.50±2.52	47.70±1.86	47.40±3.42
Live weight at the end of the experiment, kg	153.10±1.36	156.40±1.81	157.20±1.78
Absolute growth of live weight for the main period of the experiment, kg	105.60±1.53	108.70±1.92	109.80±1.62
Average daily growth of live weight for the period of 1-6 months, g	694.74±11.42	715.13±13.59	722.37±12.16
Relative growth of live weight for the period of 1-6 months, g	105.28±0.47	106.52±0.52	107.33±0.98

In the course of the experiment, it was found that the best growth rate was in calves, which received chickpea as part of the diet. In this case, the absolute increase in the live weight of the calves of the control group was 105.6 kg, which was by 2.94% lower than in the 1st experimental group, and by 3.98% lower than in the 2nd experimental group. Thus, the introduction of Privo-1 substandard chickpea in the composition of diet contributed to an increase in the milk productivity of cows and the intensity of growth of calves. In order to study the influence of chickpea seeds on the sperm production of rearing bull-calves, an experiment was conducted on animals of Kazakh white-headed breed on the basis of the breeding farm SP "Krasny Oktyabr" in the Pallasovsky District. Concentrated fodders that are part of the economic diet are represented by wheat and barley grains. It was decided to increase the protein nutrition of diets for rearing bull-calves by introducing legumes, peas and chickpea, instead of a portion of concentrated fodders for nutritional value. According to the results of the scientific-research experiment, 3 bull-calves

from each group were chosen to compare the indicators of sperm production (Table 4). The sperm of all the rearing bull-calves according to the ocular estimate was dense and homogeneous, odorless and free of impurities, had yellowish white color. The volume of ejaculate not only characterizes the degree of functional activity of the sperm, but also responds to the physiological state of the accessory genital glands, which are of great importance in the functioning of spermatozoons<sup>13, 14</sup>. The volume of the ejaculate of the bull-calves of the control group was 4.49 ml, which was lower than in the experimental ones by 0.03 ml and 0.11 ml, respectively. At the same time, the concentration of spermatozoons was higher in the sperm of the bull-calves, which were fed with chickpea as part of the diet, by 0.11 billion in 1 ml. Thus, the introduction of chickpea of Privo-1 variety in the diet contributed to obtaining a larger volume of ejaculate with an increase in sperm concentration in 1 ml. Poultry farming is the source of human food such as eggs and meat. In this connection, the search for ways to increase the productivity of agri-

cultural poultry is being conducted. Based on this, experiments were conducted to study the efficiency of using the substandard chickpea of Privo-1 variety in mixed fodders for broiler chickens and laying hens. The introduction of chickpea into the composition of

mixed fodders was carried out according to the same scheme as for cattle, instead of 75% and 100% of sunflower oil cake. To assess the meat production of the experimental broiler chickens, a control slaughter was conducted (Table 5).

**Table 4: sperm production and its quality in bull-calves**

Indicator	Group		
	control	1 experimental	2 experimental
Number of bulls	3	3	3
Volume of ejaculate, ml.	4.49±1.11	4.52±1.02	4.60±0.37
Color	Yellowish-white	Yellowish-white	Yellowish-white
Odor	Odorless and free of impurities	Odorless and free of impurities	Odorless and free of impurities
Density	D	D	D
Sperm concentration in 1 ml, billion	0.414±0.04	0.421±0.05	0.524±0.05
Activity of sperm, points	6.84±0.75	7.02±0.83	7.24±0.43

**Table 5: results of anatomical butchering of experimental carcasses of broiler chickens**

Indicator	Group		
	control	1st experimental	2nd experimental
Live weight, g	2116.67±6.49	2260±5.4***	2235±3.12***
Weight of dressed carcass, g	1509.03±2.36	1635.19±4.78***	1609.59±1.62***
Slaughter yield,%	71.29±0.11	72.35±0.05**	72.02±0.03**
Muscle mass total, g	872.35±1.36	982.26±4.27***	960.29±2.08***
Including pectorals, g	401.72±0.62	448.71±2.55***	445.4±0.68***
Edible parts of carcass, g	1031.75±1.86	1147.05±4.59***	1122.36±1.9***
Inedible parts of carcass, g	477.28±0.5	488.14±0.53***	487.23±0.28***
Including bones	462.38±0.42	472.28±0.51***	471.49±0.29***
% of edible parts to live weight	48.74±0.06	50.75±0.08***	50.22±0.02***
% of inedible parts to live weight	22.55±0.05	21.6±0.05***	21.8±0.04***
The ratio of edible carcass parts to inedible carcass parts	2.17±0.002	2.35±0.009***	2.3±0.006***

The average live weight was higher in broiler chickens, which received the chickpea of the Volgograd selection as part of the mixed fodder, by 6.77% and 5.59%, respectively. A similar pattern was observed for other indicators of meat production. In terms of the mass of the dressed carcass, a group of broiler chickens that received chickpea in place of 75% of sunflower oil cake was leading by 8.36% compared to the control and by 1.59% compared to the 2nd experimental group. The slaughter yield was also higher in the 1st experimental group and was 72.35% ver-

sus 71.29% in the control group and 72.02% in the 2nd experimental group. Thus, a partial or complete replacement in the composition of mixed fodder for broiler chickens of sunflower oil cake with substandard chickpea contributed to an increase in the slaughter yield, the weight of the dressed carcass, the yield of the edible parts of the carcass, i.e. indicators that characterized the meat production of agricultural poultry. The indicator characterizing the productivity of the laying hens is egg-laying capacity (Table 6).

**Table 6: Egg-Laying Capacity Of The Laying Hens**

Indicator	Group		
	control	1st experimental	2nd experimental
Average number of chickens, animal units.	54	54	54
Obtained eggs total, pcs.	17,361	18,176	17,890
per laying hen	321.5	336.6	331.3
% of egg laying	88.32	92.47	91.02
Average weight of eggs, g	63.40±1.87	65.78±1.93	64.93±2.01
Obtained egg mass, kg	1,100.69	1,195.62	1,161.6

During the period of the experiment, 17,361 eggs were obtained from the hens of the control group. In the experimental group, where the chickens received Privo-1 chickpea in place of 75% and 100% of sunflower oil cake, this indicator was higher by 4.69% and 3.05%, respectively. Egg-laying capacity per laying hen was 321.5 pieces in the control group, 336.6 pieces - in the 1st experimental group, 331.3 pieces - in the 2nd experimental group. At the same time, with the introduction of chickpea into the composition of mixed fodder, an increase in the average weight of the egg was observed. So, this indicator was higher in comparison with the control group by 3.75% and 2.41%, respectively, which affected egg production, which was higher in the 1st experimental group by 8.62% and in the 2nd experimental group by 5.53%. Thus, the introduction of substandard chickpea of Volgograd selection into the composition of mixed fodders for laying hens contributed to egg productivity.

### Discussion

Leguminous crops occupy an important place in the feeding of farm animals and poultry, as they take part in metabolic processes, promote the immune system of animals, stimulate growth and development, and affect the digestive processes. The studies established the superiority of the chickpea of the Privo-1 variety over other varieties selected under conditions of the Volgograd Region in terms of chemical and amino acid composition. On this basis, a series of experiments were conducted to study the efficiency of using the substandard chickpea of Volgograd selection of Privo-1 variety in the feeding of cattle and poultry. The introduction of the studied fodder promoted better digestion and intake of diet nutrients, which affected the productivity of animals and poultry.

### Conclusion

Thus, the results of the conducted studies have established that the introduction of chickpea of the Volgograd selection into diets of cattle and poultry contributes to the increase in the milk productivity of cows by 3.06-7.57%, the average daily growth of calves – by 2.94-3.98%, ejaculate volume of the rearing bull-calves – by 0.11 ml, and sperm concentration – by 0.11 billion pieces, live weight of broiler chickens at slaughter – by 5.59-6.77%, egg production of laying hens – by 3.05-4.69%. On the basis of the foregoing, in order to increase the protein nutrition of diets of cattle and poultry, it is recommended to introduce substandard chickpea of Privo-1 variety of Volgograd selection into the diets.

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