A way to increase the implementation of the bioresource potential of animals and birds

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Abstract. The work studies the consistent relationship of such basic concepts of a scientific approach to feeding highly productive animals as the "norm of animal needs for nutrients", "diet", "feed", "typical stages of preparation of feed". The mechanism and the need for deep processing of grain in the form of extrusion are considered in more detail, special attention is paid to the need for soybean extrusion. So, at OOO Meat Farms-Iskra, the use of extruded soybeans as a part of compound feeds for cattle fattening gives feed saving per 1 kg of growth of 13.6 rubles. In the production of chicken eggs by the Summer group of companies, when using mixed fodder with extruded soybeans, the cost of feed spent on 10 eggs decreases compared to the use of mixed fodder with soybean meal by 1.35 rubles. When broilers were grown at the Shushenskaya poultry farm, significant cost savings were achieved by introducing corn gluten into the diet along with extruded soybeans, while saving feed costs per 1 kg of growth compared to the basic diet was 2.2 rubles. The possibility of including extruded soybeans when feeding dairy cows at livestock complexes of EkoNivaAgro OOO in the conditions of the Voronezh region is considered.

1. Introduction
Rational, scientifically based feeding should be based on the knowledge of the norm of the animal’s body needs for energy and nutrients, which means the amount of nutrients or energy that healthy animals need in optimal conditions to maintain life, obtain a specified level of productivity and normal reproductive function. The need of animals for various nutrients is determined by the type, breed, sex, age, level of productivity, direction of productivity and other characteristics of animals, as well as the conditions of their maintenance and use.

Based on the norm of feeding make up the diet. A diet is a set and amount of feed consumed by an animal over a certain period (the daily ration is usually calculated). The term "balance" the diet means to bring it in line with the norms of feeding.

Rations, depending on the type of animals may contain various groups of feed - rough, juicy, concentrated. In this case, concentrated feed is more cost-effective to feed in the form of animal feed. Since a single raw material of plant and animal origin, which is the main and most important component of compound feed in terms of nutrient content, does not ensure the normal development of
the animal’s body, especially poultry, as it does not contain the full complex of amino acids, vitamins, microelements, enzymes and many other substances [1].

Compound feed is a homogeneous mixture of various feed products (concentrated feeds) and biologically active substances, purified and crushed to the required size, compiled according to a prescription considering scientifically based norms of input and ensuring complete feeding of farm animals.

Typical lines (stages) of the technological process of production of the feed industry are raw materials reception, cleaning of grain raw materials from weed and mineral large non-feed impurities, the separation of metallomagnetic impurities, grinding, sieving, film removal, dosing and mixing of raw materials.

To increase the feed value of grain fodder, we used additional technological processing of grain raw materials.

Extrusion is the most effective way to increase the nutritional value of cereal and leguminous components of the feed mass. During the preparation of the feed, the grain is subjected to short-term but very intense mechanical and barothermal effects due to the high temperature of 110-160 ° C, a pressure of 5.0 MPa and shear forces in the screw working bodies of the extruder, as a result of which structural, mechanical and chemical changes of the feedstock occur. Due to a sharp drop in pressure when the pre-heated grain mass exits, an “explosion” (increase in volume) of the product occurs, which makes it more accessible for the action of enzymes in the stomach of animals, and increases digestibility up to 90%. The fundamental task of the extrusion process is the deep gelatinization of starch. In this case, the degradation of starch macromolecules occurs with the formation of various dextrins and sugars, resulting in significantly increased digestibility of animal feed, and the assimilation of nutrients occurs with less energy. From the point of view of the nutrition process, the starch gelatinization process has the following meaning:

Firstly, gelatinized starch significantly increases the sorption capacity, which ensures that it absorbs a large amount of water, therefore its digestibility increases.

Secondly, due to the gelatinization of starch, the accessibility of its molecules to enzymes is significantly facilitated, therefore, the process of enzymatic hydrolysis of starch is significantly facilitated, which ensures the formation of a significant amount of dextrins and sugars of various molecular weights, up to the formation of simple sugars, glucose, etc.

As a result, nutrients move into a more accessible form, and the efficiency of the feeds processed in this way increases.

In addition, in the process of vegetation, harvesting, storage, threshing, the grain is contaminated with bacteria and fungi spores, the development of which in insects leads to grain weight loss, destruction of nutrients, accumulation of decay and metabolic products of microorganisms that change color, smell, taste, product weight.

If measures are not taken in time, the quality of products severely damaged by pests can deteriorate so much that they become harmful and unsuitable for use in feed purposes. Extruding feed will come to the rescue in this case.

When feeding with extruded feed, the death of young animals from intestinal diseases is reduced by almost half. Even then, when switching to the diet of adults, the animal has a healthy stomach, not exhausted by intestinal disorders, and is significantly ahead of its peers in growth.

Also, after heat treatment, the palatability of fodder products is improved, since various aromatic substances are formed, the activity of enzymes increases, and therefore the digestibility of the feed [2,3].

2. Material and methods of research

This paper considers the economic effect of the use of the extruder installation of the company "Expro M". The paper presents a brief description of some enterprises where this equipment is installed, calculated recipes for feed and ration compositions taking into account the cost of raw materials, on the basis of which the economic rationale for the use of ExproM extruders in meat animal husbandry
Economic efficiency was calculated based on compound feed recipes and the composition of the rations, considering the cost of raw materials.

During the period of intensive cattle fattening at OOO Meat Farms-Iskra, granulated compound feed in the amount of 7 kg is included in the ration, while the energy concentration of 1 kg of dry matter of the ration reaches 1 energetic feed unit. The paper considers the economic efficiency of using natural soybeans (group 1) and extruded soybeans (group 2) as part of granular feed.

### Table 1. The research scheme of the group of companies "Leto"

| Groups                           | Structure                                                                 |
|----------------------------------|---------------------------------------------------------------------------|
| Compound feed with soybean meal  | wheat - 5%, barley - 5%, barley without a film - 31.4%, corn - 13.1%, wheat bran - 7.1%, soybean meal - 12%, sunflower meal - 5%, meat and bone meal - 2.88%, sunflower oil - 5%, fodder yeast - 3.36%, methionine - 0.12%, salt - 0.18%, monocalcium phosphate - 0.8%, feed chalk - 4.1%, limestone flour - 5.0%, baking soda - 0.06% |
| Compound feed with extruded soy  | wheat - 5%, barley - 5%, barley without a film - 31.3%, corn - 13.0%, wheat bran - 7.0%, full-fat soybean - 10%, sunflower meal - 5%, meat and bone meal - 5.0%, sunflower oil - 3.7%, feed yeast - 5.0%, methionine - 0.14%, salt - 0.3%, monocalcium phosphate - 0.5%, feed chalk - 4.0%, limestone flour - 5.0%, baking soda - 0.06% |

### Table 2. Research scheme Shushenskaya poultry farm

| Groups                                                    | Structure                                                                 |
|-----------------------------------------------------------|---------------------------------------------------------------------------|
| Feed for broiler chickens from 5 to 7 weeks with soybean meal | Barley without a film - 15.4%, corn - 56.9%, soybean meal - 9.7%, sunflower meal - 0.6%, fish meal - 9.96%, fodder yeast - 5%, lysine monochlorohydrate - 0.27%, methionine - 0.14%, limestone flour - 1%, baking soda - 0.03%, premix - 1% |
| Compound feed for broiler chickens from 5 to 7 weeks with soybean meal and extruded soybean | Barley without a film - 26.6%, corn - 46.3%, soybean meal - 5.5%, extruded soybean - 4.1%, fish meal - 9.98%, fodder yeast - 5%, lysine monochlorohydrate - 0.32%, methionine - 0.14%, limestone flour - 1%, baking soda - 0.06%, premix - 1% |
| Feed for broiler chickens from 5 to 7 weeks with extruded soybeans and corn gluten | Barley without a film - 19.9%, wheat - 14.9 corn - 41.2%, extruded soybeans - 2.6%, corn gluten - 4.0%, fish flour - 9.99%, fodder yeast - 5%, lysine monochloride hydrate - 0.26%, methionine - 0.11%, limestone flour - 1%, baking soda - 0.04%, premix - 1% |

The following components are included in the diet of highly productive dairy cows at OOO EkoNivaAgro: Corn silage - 23.16 kg, granulated beet pulp - 1.72 kg, alfalfa haylage - 8.52 kg, barley straw - 2.27 kg. Concentrate: palm palm fat - 0.3 kg, corn - 5.04 kg, soybean meal - 2.7 kg, rapeseed - 2.11 kg, wheat - 1.8 kg, chalk - 0.04 kg. Compound feed - concentrate No. 10 - 1.6 kg. Sometimes soybean meal is absent on the farm and it is replaced with sunflower meal - 2.8 kg. We offer a partial
replacement of soybean meal with extruded soybean, while the basic composition of the diet does not change, and the feed composition along with the rest of the ingredients will include soybean meal - 1 kg, extruded soybean - 1.7 kg.

3. The discussion of the results
The livestock enterprise OOO Meat Farms-Iskra is engaged in the fattening of beef cattle to produce "marble" beef.

At OOO Meat Farms-Iskra, calves from birth and their entire dairy period of up to 6-8 months are kept on pastures and have moderate daily growths, then they are brought to feedlots where they are reared for live weight of 300 kg, the purpose of this period is to teach animals to maximize the consumption of feed used on the farm. Then begins the final stage, intensive fattening with an average daily gain of 1400-1600 grams to a live weight of about 600 kg. The plan for the cultivation and feeding of cattle at the company "Meat farms-Spark" is presented in table 3.

| Indicator                     | unit | Periods                    |
|-------------------------------|------|----------------------------|
|                               |      | lactic growing fattening   |
| Duration                      | days | 762 100 187.5              |
| Daily average gain            | g    | 666 1000 1600              |
| Live weight:                  | kg   | 40 200 300                 |
| at the beginning of the period|      |                            |
| mid-period                    | kg   | 120 250 450                |
| at the end of the period      | kg   | 200 300 600                |

Combined feed of own production is used as concentrated feed, the raw material for which is grain waste remaining after the sale of grain, that is, non-food grain. Compound feed on the farm is granulated. The composition of the feed includes equal proportions of wheat, triticale, extruded soy and sunflower meal.

Soybean grain as part of the compound feed on the farm is used in extruded form, since along with nutrients in soybean there are anti-nutrient substances, the main of which are protease inhibitors [4,5].

The best way to inactivate anti-nutritional facts in soybeans is to extrude them, since granulation alone is clearly not enough.

In addition, extruding feed for polygastric animals increases the level of by-pass protein in order to increase protein digestibility.

It is possible to provide high average daily gains due to a high energy concentration of 1 kg of dry matter of feed. This is due to the high proportion of concentrates in the structure of the diet. The increase in the efficiency of diets in the economy is due to the use of extruded soybeans in the feed composition. An economic assessment of the use of rations with the inclusion of natural soy and extruded is presented in table 4. From table 4 it is seen that the use of extruded soy in the composition of animal feed contributes to an increase in the average daily gain of the fed livestock, while feed costs per 1 kg of live weight gain decrease both in kind and in monetary terms.

In conditions of intensive animal husbandry, the inclusion of soy in the composition of animal feed is a production necessity. Soybean occupies a special place in the group of leguminous crops because of the high content of high-quality protein and fat, which provide a metabolic energy level of up to 400 kcal per 100 g. The protein content in seeds reaches 38 - 45%. Soya is used in feeding all types of farm animals in the form of flour, oilcake, meal, protein concentrates, milk, green mass [6].

Feeding of poultry is standardized for a wide range of nutrients and biologically active substances and metabolic energy. It was found that the productivity of the bird is 40-50% determined by the energy input into its body. The most important factor determining success in the rearing of young
animals and the exploitation of adult birds is high-grade protein nutrition. The inclusion of soybean
own production in the composition of animal feed is certainly economically justified.

### Table 4. Economic assessment of beef production

| Indicators | Natural soybean | Extruded soybean |
|------------|-----------------|------------------|
| The average daily gain, kg | 1400 | 1600 |
| Energetic feed unit content in the diet | 9.9 | 9.9 |
| Feed costs per 1 kg of gain, energetic feed unit | 7.07 | 6.19 |
| The cost of the diet, rub. | 152 | 152 |
| Cost of 1 energetic feed unit of the diet, rub. | 15.35 | 15.35 |
| The cost of feed spent on 1 kg of growth, rubles. | 108.6 | 95 |
| Saving feed costs per 1 kg of growth, rub. | 13.6 | |

So OOO “Agrofirm poultry farm Yenisei” is in the Altai Territory, the main area of activity is the
production of eggs. The farm successfully grows soybeans and is used as part of compound feeds for
feeding laying hens. The cost of self-produced extruded soybeans is 11 rubles per kilogram, which is
much cheaper than the purchase of expensive soy products, since the cost of soybean meal is 44 rubles
per kilogram. In addition, the use of freshly prepared feed in diets always takes precedence.

Many livestock enterprises do not have soybeans in the structure of sown areas, however,
purchased soy products are used in the diets.

Let us consider the economic efficiency of using extruded soybean using the means of the Expro M
extruder in compound feeds relative to soybean meal using the example of the Leto group of
companies - this is an agro-industrial holding whose main product is chicken egg.

So, when compound feed for laying hens is included in the recipe at the peak of the productivity of
extruded soy, instead of expensive soybean meal, the cost of feed decreases by 6.6%, with the same
nutritional value of the feed. The main zootechnical indicators of both groups did not have significant
differences. The economic efficiency of the production of eggs of the Leto group of companies is
presented in table 5.

### Table 5. The economic efficiency of egg production

| Indicators | Feed with meal | Compound feed with soy |
|------------|----------------|------------------------|
| Productivity 100 goals in 1 day, pcs. eggs | 90 | 90 |
| Energy requirement for 1 head per day, kcal | 305 | 305 |
| The need for feed, 1 head per day, g | 112.5 | 112.5 |
| Feed costs per 10 eggs, kg | 1.125 | 1.125 |
| The cost of 1 kg of feed, rub | 15.827 | 14.79 |
| The cost of feed per 1 head per day, rubles | 1.78 | 1.66 |
| The cost of feed per 100 goals for 1 day, rub | 178 | 166 |
| The cost of feed spent on 10 eggs, rubles | 19.8 | 18.4 |
| Feed cost saving for 10 eggs, rub | 1.35 | |

From the table of economic efficiency of egg production, it is seen that when the poultry egg
production is 90%, when using compound feed with extruded soybeans, the cost of feed spent on 10
eggs is reduced relative to the use of compound feed with meal.

Broilers are hybrid chickens obtained by crossing two, three or more lines of chicken meat breeds.
They have a high growth rate, so they feel an increased need for energy and protein.
Consider the economic efficiency of the use of extruded soybean in mixed feed relative to soybean meal on the example of the Shushenskaya poultry farm (Table 6), which is in the Krasnoyarsk Territory and is engaged in the cultivation of broilers. Soybean in the Krasnoyarsk Territory does not give a decent harvest, because its economy does not cultivate, but purchases soy products.

Slaughter of poultry is performed at 43 days of age with a live weight of 2.5 kg. In this case, the average daily gain is 58.1 g. With the nutrition of feed for broiler chickens aged 5 to 7 weeks 295 kcal and the average energy requirement during this period is 200 kcal g / head / day, feed consumption will be 67.8 g.

Table 6. Cost-effectiveness of broiler growing

| Indicator                              | with soybean meal | Compound feed with soy and meal | with soy and gluten |
|----------------------------------------|-------------------|---------------------------------|--------------------|
| The increase in live weight g / goal   | 58.1              | 58.1                            | 58.1               |
| Nutrition 100 g of mixed feed, kcal    | 295               | 295                             | 295                |
| Need, kcal / goal / day                | 200               | 200                             | 200                |
| Consumes feed g / goal / day           | 67.8              | 67.8                            | 67.8               |
| The cost of feed per 1 kg of growth, kg| 1.17              | 1.17                            | 1.17               |
| The cost of 1 kg of feed, rub          | 18.989            | 18.731                          | 17.114             |
| The cost of feed spent per 1 kg of growth, rubles | 22.22 | 21.9 | 20.02 |
| Saving feed costs per 1 kg of growth, rubles | 0.3 | 2.2 | |

A compiled diet with soybean meal was the most expensive. It was not possible to balance the diet by completely replacing soybean meal with extruded soybean with the same set of feeds, the protein was the limiting one. Therefore, a ration was compiled with a partial replacement of soybean meal with extruded soybeans. At the same time, feed cost savings per 1 kg of growth amounted to 0.3 rubles. Significant cost savings were achieved by introducing corn gluten into the diet along with extruded soybeans, while saving feed costs per 1 kg of growth relative to the basic diet was 2.2 rubles.

Let us consider the possibility of including extruded soybeans when feeding dairy cows at the livestock complexes of OOO EkoNivaAgro in the conditions of the Voronezh region.

OOO EkoNivaAgro has been operating since March 2002. The main activity is dairy farming. The enterprise is the largest milk producer in the Voronezh region - 665 tons daily, which is more than 25% of the total regional figure. The enterprise includes 26 livestock divisions: nine modern dairy complexes and 17 reconstructed livestock farms.

In the diets of dairy cows on the farm, one of the most expensive components is soybean meal [7.8]. On the farm, there are situations when soybean meal is absent, in this case it is replaced by sunflower meal by the level of crude protein, but the by-pass protein level decreases, while the level of milk productivity decreases.

According to the experience of many farms, the alternative to using expensive soybean meal is the use of full-fat soybean, especially since it is grown on the farm. Soybean yield is 18 kg / ha, at a cost of 15,390 rubles per ton, which is much cheaper than purchased soybean meal (32,634 rubles per ton). The best way to inactivate anti-nutritional facts in soybeans is to extrude them, which also increases the level of by-pass protein.
A complete replacement of soybean meal with extruded soybean meal is not feasible, according to experts, due to an increase in the level of fat, which consists of unsaturated fatty acids that adversely affect scar digestion.

From table 7 of the economic efficiency of feeding dairy cows using soybean meal, sunflower meal and extruded soybeans, using soybean grains of our own production saves feed costs per 1 kg of milk 0.94 rubles, by reducing the cost of rations.

| Indicators | Basic diet with soybean meal | Sunflower meal ration | Diet with partial replacement of soybean meal with extruded soybean |
|------------|-----------------------------|----------------------|---------------------------------------------------------------|
| Dry matter intake, kg | 24.73 | 24.82 | 24.76 |
| Received milk, kg / goal / day | 35 | 30 | 35 |
| From 1 kg of dry matter obtained milk | 1.42 | 1.21 | 1.41 |
| Diet cost | 370 | 328 | 337 |
| Cost of 1 kg of milk, rub | 10.57 | 10.93 | 9.63 |
| Feed cost savings per 1 kg of milk, rub. | 0.36 | 0.94 | |

The cost savings on livestock will be: 2 800 animals * 10 000 kg * 0.94 rubles = 28 000 000 * 0.94 = 26 320 000 rubles.

Economic efficiency was calculated without considering the costs of extrusion. Calculate the cost savings using an extruder company Expro M.

1. The use of extruded soybeans per year will be:

\[ 1.7 \text{ kg / goal / day} \times 2800 \text{ goals} \times 300 \text{ days} = 1,428,000 \text{ kg} \]

2. The amount of time it takes to extrude a given volume of soybean grain, with a productivity of 1200 kg / h:

\[ 1 \text{ h} - 1 \text{ 200 kg} \]
\[ X \text{ h} - 1 \text{ 428 000 kg} \]
\[ X = 1,190 \text{ hours} \]

3. The amount of energy spent, if the power of the extruder is 112.25 kW / h

\[ 1 \text{ h} - 112.25 \text{ kW} \]
\[ 1,190 \text{ h} - x \text{ kW} \]
\[ X = 133 875 \text{ kW} \]

4. The amount of money spent on extrusion if the cost of 1 kW 3.74 rubles:

\[ 1 \text{ kW} - 3.74 \text{ rub} \]
\[ 133 875 - x \text{ rub} \]
\[ X = 500 692.5 \text{ rubles} \]

Thus, the saving of feed costs with the partial replacement of soybean meal with extruded soybean will be: 26,320,000 - 500,692.5 = 25,819,308 rubles. Savings in feed costs, considering the cost of the extruder 1,320,000 rubles, will be: 25,819,308 - 1,320,000 = 24,499,308 rubles.

4. Conclusion

Thus, the inclusion of the extrusion process in the feed preparation chain contributes to the production of high-quality feed - one of the main factors in increasing the productivity of animals and poultry and lowering the cost of feed for growing modern breeds of animals and poultry crosses with high genetic potential, high intensity of physiological and biochemical processes requiring constant and stable intake of a high level of nutrients and biologically active in their body substances.
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