

Development of Production Extruded Feed for Industrial Production of *Tilapia*

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Abstract

In the result of the analysis of domestic experience over the last 10 years of foreign experience (for example, 9 countries: Vietnam, India, Spain, Canada, China, Norway, USA, Chile, Japan, which possess the most advanced technologies and equipment for highly efficient production of feed for fish) in the development of innovative technologies and equipment for production of high-performance fish feeds were identified that the methods both dry and wet pressing are outdated and do not meet modern requirements in the production of fish feeds since it does not allow a deep physical-chemical transformations in protein-carbohydrate complex and exercise enter fat components at 40%. Modern fish technologies are based on the use of extrusion processing of multicomponent mixture to give different buoyancy and adjustable rate of immersion of the resulting feed.

Extrusion technology will allow to introduce a large amount of fat into the product - up to 35 - 40%, to achieve 100% starch splitting level. The extruded product has a high water resistance, retains its shape. The developed formulations of new generation feed for *Tilapia* with a protein content of 60%, fat 40%, with the introduction of growth promoters, biologically active additives, etc. will increase the digestibility of fish feed by 10 - 12%, increase fish weight gain by 10 - 12%, reduce the cost of commercial fish products by 10 - 15%, reduce feed conversion by 15%. The proposed technology will allow to create a new generation of feed formulations for different types of fish with a high content of protein-fat complex, which will increase the weight gain of fish by 12 - 17%, reduce the cost of final fish products by reducing the cost of feed by 10 - 15%.

Keywords: *Tilapia*; Product Feed; Feed Production; Optimization of Rations

Introduction

The fishery complex plays an important role in ensuring the food security of the Russian Federation. The current situation - the food embargo imposed in response to anti-Russian sanctions - has updated the issues of import substitution and ensuring food independence. These tasks were set by the President's Decree of August 6, 2014 No. 560 "On the application of separate special economic measures to ensure the security of the *Russian Federation*". One of the targets for food safety is the self-sufficiency rate of fish products [1,6].

For aquaculture in the country produce about 110,000 tons of feed per year, and the need of the industry exceeds 200,000 tons. In addition, the price is logistical costs [2,7].

Most of the domestic feed sources for fish cannot replace imports because of the low quality. New and out-of-the-way nutrition have a negative impact on fish productivity.

A promising direction of freshwater aquaculture is industrial fish farming, one of the main representatives of fish grown in it is nillapia - *Oreochromis niloticus*.

Growing *Tilapia* in pond and industrial farms has shown that they eat well both plant and animal feed. The need for *Tilapia* in protein for growth is slightly lower than that of carp, eel and trout. In Asia and Africa, rice bran, ground rice, aquatic and terrestrial plants and all kinds of food waste are used as feed. In our country, when pond cultivation of tilapies in monoculture they are fed grain waste, meal, feed, used in the cart. For young people weighing up to 50 grams use feed WBS-R-81, RSGK-1, 16-82, and for *Tilapia* weighing 50 grams and above - PC-Vr, RGM-2KE, etc [3-5,8-11].

Tilapia is very unpretentious to the conditions of maintenance, temperature and water quality. Almost all types of *Tilapia* can live, develop normally and reproduce normally in fresh, brackish and even sea water, which is a very rare property for fish. Despite the fact that most *Tilapia* are tropical fish, some species can exist at a very wide range of temperatures (from 10 to 45 degrees maximum).

Tilapia meat will contain a large amount of balanced protein, saturated fatty acids, it lacks carbohydrates. Fish is a source of vitamins: A, groups B, E, D, K, PP, thiamine, riboflavin. *Tilapia* is rich in various amino acids, 8 of which are essential.

Research Methodology

In order to make formulations of the products of extruded feeds for *Tilapia*, a wide analysis of the raw materials of plant and animal origin was carried out, as a result of which the EcoFeed program has developed a promising resource-saving formulation (Table 1) while minimizing the cost of feed. Feed combi is evaluated by the chemical composition, invariability of nutrients, mineral content and vitamins, especially carotene (provitamin A), and the amount of energy that can be used for the production of products and physiological processes occurring in the body of fish.

Choosing the prescription composition of feed for *Tilapia* took into account a number of factors. First, it is necessary to enrich extruded feed with fats and proteins of plant origin and minerals to reach their physiological dose. It is necessary to get balanced on food value and with a developed structure of extrudate. Second, achieve a pleasant taste, aroma and attractive structure that will change the traditional characteristics of the components. Third, increasing the shelf life of feed.

The main raw materials in the production of extruded feed in accordance with the study's task are fat waste of the oil and fat industry (soap stock, phosphatides), meal and meal of atheroma's.

Soap stock in the diets of animals and fish is dosed by the amount of fat. 1 kg of soap stock contains 8500 - 8700 kcal of metabolic energy, which corresponds to energy 3.4 kg of concentrated feed. Improves the efficiency of nitrogen use.

Soap stock contains a certain amount of glycerides, fatty acid salts, phosphate and biologically active substances such as choline, tocopherols, carotenoids.

Phosphate concentrate includes up to 60% phosphatides, 36% fat, 2% moisture and protein, is a source of phosphorus, potassium, iron, manganese, zinc, helping fish avoid fatty liver rebirth and anemia. It has good emulsion ability, properties of hydrophilic colloids, and therefore can be used as a binder in the granulation of feed.

Phosphate concentrate is also recommended as a carrier of antioxidants (diludin and santohina) in the amount of 2 - 4% to stabilize biologically active substances in premixes and BVD.

As a flavoring used meal and meal ethereal crops, for example, coriander.

For *Tilapia* larvae in industrial growing conditions it is desirable to use feed with a content of 40 - 45% protein and 10 - 11% fat. Young people grow well on feeds containing 26 - 30% protein and 7 - 10% fat. Increased protein content does not lead to a significant acceleration of growth. The daily rate of feed depends on the temperature of the water and body weight.

The feed recipes we offer to use are listed in the table 1.

Components	Content, %
Barley	19,8
Wheat bran	4,1
Corn gluten	10,2
Coriander meal	2,9
Sunflower meal	8
Soybean meal	8
Yeast, fodder	19,5
Flour fish-Petrop 57%	20
Fish oil	1
Sunflower fuz	2
Sunflower phosphates	2
Bentonite	1
Monocalcium phosphate	0,4
Vitamin B4	0,1
Premix	1

Table 1: Recipes of production feed for *Tilapia*.

The tour’s receptionist met with all the requirements for feed for the preparation of extruded production feeds for *Tilapia*.

Results of the Research

In order to determine the exchange energy of the received feed, the contents of the basic physical-chemical and biochemical indicators are examined, allowing to judge the advantages of the extracted feed and for *Tilapia* (Table 2).

The average weight of 7.7 grams and 7.44 cm long was tested. Feeding this feed contributed to an increase in the average daily increase in the live mass of young *Tilapia* fish (Table 3).

With the protein of the total protein, as well as the proteins of the sarcoplasma made up for the *Tilapia* grown according to the proposed recipe -37.98 and 13,4 mg/g, the level of common lipids in the muscles of *Tilapia* was within 0.92%, which indicates low fat content of meat. *Tilapia* to medium-protein (See table 4).

Indicators	Content
Mass fraction of moisture, %	6,73
Raw protein, %	33,81
Raw fat, %	9,68
Raw fiber, %	4,9
Ash, %	6,64
Linoleic acid	1,88
BEV, %	35,05
Lysine, %	2,04
Methionine, %	0,54
Methionine+cystine, %	1,38
Tryptophan, %	0,34
Sugar, %	11,36
Starch, %	0,65
Phosphorus, %	0,97
Calcium, %	1,20
B. energy, kcal/100g // MJ/kg	489,89 // 20,45
O energy, kcal/100g // MJ/kg	440,91 // 16,37

Table 2: Physics-chemical and biochemical indicators of extruded production feeds for *Tilapia*.

Indicators	Feed on the proposed recipe	Foreign-made feed
Initial mass, g	7,7 ± 0,37	8,22 ± 0,61
Initial length, cm	7,44 ± 0,13	7,32 ± 0,22
Final mass, g	16,56 ± 1,55	17,35 ± 1,17
Initial fatness, g	1,89	2,07
Fatness final, g	1,94	1,95
Final length, cm	9,45 ± 0,17	9,60 ± 0,25
Absolute increase, g	8,97	9,12
Survival, %	100	100
Average daily increase, %	2,60	2,48
Growing time, day.	30	30

Table 3: The tests of feeding the production feed for young *Tilapia*.

Fodder	Content of common lipids in muscles, %	Water-soluble protein content in muscles, mg/g	Total protein content (with recalculation from the cry of the water from the created protein) in the muscles, %
Feed on the proposed recipe (option 1)	0,92 ± 0,01	37,89 ± 2,05	13,4 ± 0,22
Foreign-made feed (option 2)	0,81 ± 0,04	35,4 ± 2,05	11,9 ± 0,68

Table 4: Content of common lipids and water-soluble protein (with conversion to general protein) in *tilapia* muscles.

The resulting feed was characterized by the following organoleptic indicators: appearance - extrudate slightly deformed, cylinders with a structure of varying degrees of porosity, without cracks; color - corresponded to the color of the extruded feed, from which the pellets are prepared, or darker (when entering dyes - the color of the corresponding dye); the smell - corresponded to a set of benign components, incoming in the feed of the mould smells.

Conclusion

To the complex of scientific research in the development of extracted extruded feeds can be of interest in the field of full feeding of *Tilapia*, as well as allow to expand the range of produced multi-component feeds with a sufficiently high biological, energy value, balanced by the composition of essential amino acids, vitamins and minerals adapted for different species of fish.

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