

RESEARCH ON THE EFFECTS OF FEED BIO-ADDITIVES (ACTIGEN, SELPLEX, YEA-SACC-1026) ON GROWTH INDICES AND BLOOD SAMPLES IN THE SIBERIAN STURGEON (*ACIPENSER BAERII*)

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Abstract. The research has tracked the effects of Actigen, Sel-Plex and Yea-Sacc-1026 fodder bio-additives on growth and blood indices in the Siberian sturgeon (*Acipenser baerii*). The experiments were carried out on a number of 108 sturgeons distributed in four groups, each group with 27 sturgeons/group. Experimental group 1 was fed with the combined Actigen feed in a proportion of 0.08%, 0.03% Sel-Plex was added to the experimental group 2, and 0.2% Yea-Sacc-1026 was added to the third experimental group. The experimental period lasted 23 weeks, from 25th of May – 2nd of November 2017. During the experiment, the body mass, growth rate, feed consumption, total biomass and survival rate were followed. Body weight at the end of the experimental period has increased by 24.8% for experimental group 3 (0.2% Yea-Sacc) compared to the control group. Concerning the final biomass there is an increase in experimental group 3 (0.2% Yea-Sacc) compared to the control group of 29.51%. Growth evolution shows an increase of 90.15% in experimental group 3 (0.2% Yea-Sacc) compared with the control group. The effects of bio-additives on the mortality rate were positive in the experimental groups, with no loses. Regarding to blood indices, the following were observed: the hemoglobin concentration did not show significant differences in the experimental groups compared to the control group. The correlations between blood indices and erythrocyte ratios revealed an anemic syndrome in the control group. The hematocrit value was improved in experimental group E1 (36.6% Actigen) and showed very significant differences when compared with the control group; Significant differences were also recorded between the experimental groups E1 and E2 (Actigen and SelPlex) compared to the experimental group E3 (Yea-Sacc), the latter showing lower values than the rest of the groups (24.6%).

Keywords: actigen, sturgeon, haemoglobin, hematocrit

INTRODUCTION

Some feed additives (Actigen, SelPlex, Yea-Sacc) which are used in terrestrial and fish feed favor the development of microorganisms useful in the digestive tract and thus contribute to maintaining health and increasing productive performance (Șara and Bențea, 2012). Corneillie (2014) determined that the addition of Actigen at a concentration of 0.12%, in the feed of pangasius fish contributed to higher performance of weight gain of the fish material. This experiment also revealed that pre-biotic Actigen had a positive effect compared to the Enrofloxacin antibiotic, the experimental groups having a higher survival rate. Abdel-Tawwab (2012) showed that using yeast as a probiotic in fish feed leads to increased resistance to bacterial infections and increased digestive enzyme activity in the intestine. Organic selenium (Sel-Plex) fed fountain trout (*Salvelinus fontinalis M.*) had positive effects on growth performance and survival rate (Șara et al., 2009a; Șara et al., 2010; Barbu et al., 2009).

The analysis of correlations of haematological indices was the basis for quantification of health status and survival rates - mortality, reflecting the beneficial biological effects

produced by the three feed additives (Actigen, SelPlex and Yea-Sacc) with a major impact on the fisheries sector).

Many research studies have proven the biological value of the main haematological indices needed to assess fish health and further suggested more complex tests to determine the action of cellular defense factors. We propose the analysis of the correlations between the erythrocyte indices needed to develop a haematological model for assessing the health status of fish and to quantify the influence of the three feed additives (Actigen, SelPlex and Yea-Sacc).

MATERIAL AND METHODS

The research was conducted at ICAS Gilău trout farm, Cluj County, Romania. The period lasted from July to November and included a number of 108 fish divided into 3 experimental groups (Actigen 0.08%, Sel-Plex 0.03% and Yea-Sacc-1026 0.2%) and a control group. The species of interest was represented by the Siberian sturgeon (*Acipenser baeri*). The fish were approximately 21 months old. At the beginning of the experiment the biologic material had a body weight of 700 grams per individual and 58cm body length. The groups were accommodated under the same conditions in identical concrete tanks (tanks of 4 x 1 x 1.3 m) each supplied with water from a reservoir at a constant flow rate of 20 l/min. Water temperature ranged from 13.0 °C to 17.2 °C. The monitored chemical parameters of the water were: dissolved oxygen, pH, nitrites, nitrates and nitrogen ammonia.

The feed used was 5 mm Skretting pellets without any additives for the control group and with added additives for the other groups as follows: group 1 received Actigen added in a ratio of 0.08%, group 2 received Sel-Plex added in a ratio of 0.03% and group 3 received Yea-Sacc-1026 added in a ratio of 0.2%.

The feed was administered in two portions per day at 9 A.M. and 6 P.M. The quantity of feed administered varied based on water temperature, total biomass and fish appetite. The surgeons were individually weighed at the start of the experiment and at every 4 weeks interval. The monitored growth indices were specific growth rate, body mass, total biomass, food conversion ratio and survival rate.

Table 1

The monitored chemical parameters of tank water

Specification	M.U.	Value
O ₂	mg/l	6.4
pH	pH	7.18
Sulphates	mg/l	32
NO ₂	mg/l	0
NO ₃	mg/l	0
NH ₃	mg/l	0

Haematological tests were made in the profile hematology laboratory from University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca and consisted of hemograms. For this purpose 8 ml of blood was drawn in Heparin from each individual by puncturing the caudal artery with, following the specific methods (Ognean et al., 2007), for determining hemoglobin (Hb), total number of erythrocytes (E) and the hematocrit (Ht).

The experimental data was statistically analyzed using the T-test based on Graph Pad InStat 3 program.

RESULTS AND DISCUSSION

The mean values and variability of body mass of the Siberian sturgeon during the experimental period are represented in table 2.

Table 2

Group	N	Average body weight (g/fish)				$\bar{X} \pm s_x$	V%
		Initial		Final			
		g	%	g	%		
Control	27	742	100	874	100	874±51.91	28.27
1E (Actigen 0.08%)	27	753	101.48	953	109.03	953±32.98**	19.59
2E (SelPlex 0.03%)	27	675	90.97	894	102.88	894±25.37	20.2
3E (Yea-Sacc 0.2%)	27	840	113.20	1091	124.82	1091±44.09***	15.35

*** - $P < 0.001$; ** - $P < 0.01$; * - $P < 0.5$.

All experimental groups have improved their body weight when compared to the control group (table 2). The highest recorded value for body weight was registered in group 3E (1091g), which had 0.2% Yea-Sacc-1026 added to the feed, representing an increase of 24.82% compared to the control, while group 1E which received 0.08% Actigen showed an increase of 9.03%. Group 2E which had 0.03% organic selenium added to the feed and the control show similar growth rate values, 874g for the control and 894 for lot 2E, representing an increase of only 2.88%. The differences recorded in group 3E are very significant from when compared with control group. The control group as well as group 2E exhibit a high variability regarding body weight between individuals ($20\% < V\% < 30\%$), while group 3E has a medium variability ($V\% = 15.35\%$). The obtained results are comparable with similar experiments conducted by Hung et al. (2011, 2012), Abdel-Tawwab (2012), Thorarinsson et al. (1994) on different species of fish. The effects of the fodder additives administered in the fish feed (Actigen 0.08%, Sel-Plex 0.03% and Yea-Sacc 0.2%) of the 4 groups are represented in table 3.

Table 3

Growth performance values registered on Siberian sturgeon at the end of the experiment

Specification	M.U.	Control	1E (Actigen 0.08%)	2E (Sel-Plex 0.03%)	3E (Yea-Sacc 0.2%)
Growth rate	g	132	200	219	251
	%	100	151.51	165.90	190.15
Specific growth rate	g/day	0.94	1.42	1.56	1.79
	%	100	151.06	165.95	190.42
Final biomass	kg	22.7	25.75	23.18	29.4
	%	100	113.43	102.11	129.51
FCR		1.86:1	1.38:1	1.32:1	1.18:1

Analyzing the main production indices recorded during the experimental period it can be observed a favorable influence of the bio-additives administered (0.08% Actigen, 0.03% Sel-Plex and 0.2% Yea-Sacc) in the fish feed in regards to growth rate has been observed. The growth rate was improved by 90.15% in experimental group 3E (0.2% Yea-Sacc) compared to the control group. Also the specific growth rate of group 3E has increased

by 90.42% compared to the control. Regarding the final biomass, an increase of 29.51% can be observed in group 3E. Experimental groups 1E and 2E show similar differences when compared to the control. A growth rate increase of 51.51% was recorded in group 1E and 65.90% in group 2E which in turn lead to an increase in specific growth rate of 51.06% in group 1E and 65.95% in group 2E. The final biomass of experimental group 1E increased by 13.43% compared to the control group, while experimental group 2E revealed similar values to the control with an increase of only 2.1%.

Analyzing the feed conversion ratio, similar values can be observed in groups 1E and 2E (1.3:1). The lowest value of feed conversion ratio (1.18:1) was observed in experimental group 3E (0.2% Yea-Sacc) when compared to the control group (1.86:1). No losses of fish were registered during the experimental period. The obtained results are comparable with similar experiments conducted by Razeghi et al. (2012) on giant sturgeon (*Huso huso*) juvenile.

The values of haematological indices are presented in table 4.

Table 4

Red blood cells (RBC) values in the Siberian sturgeon at the end of the experimental period

Specification	U.M.	Control	1E (Actigen 0.08%)	2E (Sel-Plex 0.03%)	3E (Yea-Sacc 0.2%)
N	individuals	5	5	5	5
Haemoglobin	g/dl	12.6±0.17	12.52±0.18	11.86±0.19	12.3±0.26
Hematocrite	%	28.4±1.12	36.6±1.20	28±1.22	24.6±1.50
RBC	mil/mm ³	2.07±0.15	2.67±0.20	2.44±0.10	2.96±0.11

The bio-additives addition in feed has generally led to an improvement of the erythrocyte indices in the experimental groups compared to the control group.

Table 5

Statistical significance (the T-test) of the differences between the four batches in haematological index values

Comparison	Average differences	q	P
Hematocrite			
E2 vs E1	-8.600	6.757	<0.001 ***
E3 vs E1	-12.000	9.428	<0.001 ***
M vs E1	-8.200	6.443	<0.001 ***
Erythrocytes			
E1 vs M	0.606	3.941	<0.01 **
E3 vs M	0.898	5.871	<0.05 ***

***P<0.001- very significant differences, ** P<0.01- distinct differences.

The hemoglobin concentration did not show significant differences in experimental groups compared to the control group. Regarding the number of erythrocytes, it was found to increase in all three experimental groups compared to the control group; the highest value (2.96 mil/mm³) was recorded in experimental group E3 (YeaSacc). Erythrocytes value recorded in the control group (2.07 mil/mm³) may suggest the persistence of an anemic syndrome. The hematocrit value was improved in experimental group E1 (Actigen), recording very significant differences (P <0.001) as comparison with the control group; significant differences were also recorded between the experimental groups E1 and E2

(Actigen and SelPlex) compared to the experimental group E3 (Yea-Sacc), the latter showing lower values than the rest of the batches. An increase in hematocrit value due to bio-adhesive administration was also reported by Genç et al. (2007) and Welker et al. (2007) in different acipenserides and carp (Koumans et al., 1994).

The values obtained in the three experimental groups (Actigen, SelPlex and Yea-Sacc) are within the normal limits of the Siberian sturgeon (Simon, 2017).

CONCLUSIONS

- The use of bio-additives in Siberian sturgeon feed has resulted in food assimilation improvement, thereby improving the growth performance.

- The use of bio-additives (Actigen, SelPlex, Yea-Sacc) determined a constant evolution of body mass in all groups, without the occurrence of regressions. The body mass of the experimental groups was higher compared to the control group.

- The highest growth rate was registered in the E3 Yea-Sacc group (90%), followed by groups 1E and 2E both being net superior to the control group.

- The growth rate was greatly improved by bio-additives adding to all experimental groups compared to the control group. The highest growth rate was recorded in experimental group 3E Yea-Sacc.

- The feed conversion ratio has been significantly improved in all experimental groups compared to the control group. The lowest rate was recorded in the E3 Yea-Sacc group (1.18:1) and the highest (1.86:1) in the control group.

- Low erythrocytes values counts persistent anemic syndrome in the control group, while the experimental groups have normal values.

- The highest hematocrit value was recorded in the E1 Actigen group (36.6%), the groups E2 and E3 did not significantly differ from the control group.

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