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The Influence of Organic Selenium on the Growth and Survival Performances of the Common Carp (*Cyprinus carpio* L.), Galiţian and Lausitz Variety, Juveniles

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Abstract. This paper presents experimental results regarding the use of organic Se (Selplex) in the nutrition of the juveniles of the common carp (*Cyprinus carpio* L.), the Galitian and Lausitz variety, reared together. The experimental work was carried out during 159 days in the Martinesti Fish Farm, near the city of Cluj-Napoca, Romania. Four different batches have organized: two experimental batches and two witness batches. One experimental batch and one witness batch, each consisting of 200 Lausitz juveniles and respectively 100 Galitian juveniles, correspond to both of the fish varieties. The mean weight of the juveniles in each batch at the beginning of the experiment was 1.5 g/specimen. The rearing conditions were similar for both groups, excepting the alimentation. Both experimental batches received 0.03 mg organic Se (Sel-plex) per kg fooder.

After 159 days the Galitian juveniles had a mean weight of 283.265±1.287g/specimen, and a survival rate of 98%, compared to the lower weight of the witness batch (266.382±1.457g/specimen) and a survival rate of 94%. The values corresponding to the Lausitz juveniles batches are: 354.619±0,088g and 276.804±0,051g for the mean weight and 99% and 97% for the survival rate. These results confirm the benefits of using Se (Sel-plex) in the common carp nutrition. The growth and survival indicators are improved when Se is employed.

Keywords: organic selenium, alimentation, rate of survival, growth performance, common carp

INTRODUCTION

The importance of Selenium (Se) for the environment lead to the increased attention this element is receiving in different scientific fields (e.g. biology, chemistry, economy) since few decades ago (Lemly, 2002). Even though Se was discovered in 1817 by Berzelius Jons Jakob (Surai, 2004), its importance in the nutrition was acknowledged more than 100 years later, in 1957 (Steven, 2007).

Se is vital for animals, including fishes, due to its participation in glutation peroxydaze (GSH-Px) (Lyons De Silva Mariana, 2007), the most common Se based protein, present in all tissues where oxidation processes take place (e.g. intestines, cellular membranes, spermatozoids) (Surai, 2004). The cytoplasm GSH-Px is considered an “emergency enzyme” which prevents the oxidative shock (Kohrle et al., 2000). The cells and membranes are protected against the oxidative stress (Takeshi, 1997 et al; Bell et al., 1986). Se is also assimilated in other enzymes and proteins with importance in the body development, reproduction and immunity (Power, 2007).

The low level of Se in the alimentation of common carp leads to decreased body weight, cataract and anemia (Lovell, 1987), while the usage in optimum amounts leads to a lower fodder conversion rate, prevents the meat oxidation, improves the immunity, growing

rate, meat quality (Lyons P.F., 2002) and reproduction efficiency (through a higher survival rate associated to hatching and prevention of the teratogenic process) (Lemly, 2004).

The purpose of the present research is to investigate the influence of organic Se (Sel-plex) on the growth indices and survival rate of the juveniles of two common carp varieties (Galitian and Lausitz).

MATERIALS AND METHODS

The experiment was organized between 09.06.08 – 15.11.08 at Martinesti Fish Farm, located in Cluj County, Romania. 400 common carp juveniles, Lausitz variety, were organized in two equal batches (experimental and witness), while just 200 juveniles from the Galitian variety suffered the same process. The four batches, involving individuals 21 days old with a mean body weight of 1.5 g/specimen where stocked in two tanks: (1) an experimental tank (Bd1) and (2) a witness tank (Bd2); each one hosting 300 individuals from both verieties.

Fig. 1. Common carp juveniles at the beginning of the experiment (left) and the rearing tanks (right): left tank – witness and right tank – experimental.

The two tanks (Figure 1) offered the same rearing conditions (water quality, fish density, feeding schedule and fodder quantity), excepting the fodder characteristics, as explained later. Water and tanks characteristics were monitored on a daily basis (see parameter values in Table 1).

Tab. 1

Water and rearing tanks characteristics

Mean tank depth (m)	1,2
Tank surface (mp)	975
Mean water temperature (^{0}C)	20,83
Minimum water temperature (^{0}C)	15
Maximum water temperature (^{0}C)	28,7
Mean oxygen concentration (mg/l)	7,2
Mean pH	7,9

The fodder consists of: 38% proteins, 5% fat, 3.5% pulp and 9% humidity. For the experimental batch the fodder included also 0.03 mg organic Se (Sel-plex) per kg.

The feeding began the day when juveniles were put into the tanks, and followed a strict schedule during the experiment, as explained in Table 2. The fodder was spread manually each time.

Tab. 2

Feeding schedule and distributed quantities depending on the feeding hour

Period	Feeding hour	Fodder quantity (%) of the total daily ammount
09.06.08 – 15.07.08	8^{00}	30
	13^{00}	40
	19^{00}	30
16.07.08 – 15.10.08	8^{00}	40
	18^{00}	60
16.10.08 -15.11.08	18^{00}	100

The growth indices were monitored through weighting: twice per month in the first period and once per month during the rest of the experiment. The biometric indicators and survival rate were registered in the same time. The values were analysed with the statistic program Anova. The Fulton index (optimum value 1,8) was calculated using the next formula:

$$K = (W/I^3) \times 100$$

where: K = Fulton coefficient; W = fish weight (g); L = standard fish length (cm).

RESULTS AND DISCUSSION

Table 3 shows experimental data related to the body mass measurements, which reveal the superior progress of the Lausitz (EL) variety from the experimental batch. This had higher mean body mass even since the first control fishing (30.0±0.030g/specimen), compared to the experimental Galitian juveniles (EG): 20.05±0.060g/specimen; and the witness batches (Lausitz (ML): 20.02±0.072g/specimen and Galitian (MG): 15.02±0.038g/specimen).

Tab. 3

The evolution of the juveniles body mass during the experiment

Date	Mean individual body weight (g)							
	N	ML	N	MG	N	EL	N	EG
09.06.08	200	1.50±0.009	100	1.50±0.007	200	1.50±0.009	100	1.50±0.007
25.06.08	50	20.02±0.072	25	15.02±0.038	50	30.0±0.030	25	20.05±0.060
15.07.08	50	8.52±0.137	25	85.63±0.463	50	101.30±0.130	25	97.26±0.125
15.08.08	50	158.18±0.192	25	140.19±0.182	50	177.86±0.190	25	165.97±0.200
15.09.08	50	229.30±0.150	25	221.19±0.174	50	253.05±0.140	25	232.04±0.160
15.10.08	50	273.06±0.640	25	261.08±0.200	50	327.65±0.070	25	279.78±0.802
15.11.08	194	276.80±0.051	94	266.38±1.457	198	354.61±0.088	98	283.26±1.287

ML – witness batches Lausit; EG - experimental batch Galitian; MG – witness batches Galitian; EL - experimental batch Lausitz; N – number of fish (individuals)

At the end of the experiment EL had a mean body mass of 354.61±0.088g/specimen, while the value corresponding to ML was 276.804±0.051g/specimen. Better value of the mean body mass was regisered for EG also (283.26±1.287g/specimen), compared to MG

(266.38±1.457g/specimen). All measurements displayed in Table 4 show better parameters associated to the juveniles from the experimental batch compared to the witness batch.

Tab. 4

Body characteristics at the end of the experiment

Parameter	ML	MG	EL	EG
Mean body weight (kg)	276.80±0.051	266.38±1.457	354.61±0.088	283.26±1.287
Minimum body weight (kg)	0.240	0.240	0,300	0.240
Maximum body weight (kg)	0,320	0.280	0,500	0.300
Mean body length (cm)	24.191±0.04	23.847±0.03	25.954±0.06	23.973±0.04
Mean body height (cm)	9.184±0.05	8.886±0.02	9.735±0.02	9.901±0.01
Mean small body height (cm)	3.066±0.07	3.024±0.005	3.255±0.04	2.985±0.006
Mean length of the caudal fin (cm)	3.192±0.02	3.260±0.01	3.066±0.06	3.256±0.01
Mean length of the head (cm)	6.526±0.04	6.148±0.04	6.575±0.02	6.137±0.02
Mean K	1.64	1.69	1.78	1.74

Figure 3 shows juveniles from the experimental (+Se) and witness (-Se) batches during the experiment. The photographed experimental specimens weight around 0.500 g (EL) and 0.300 g (EG).

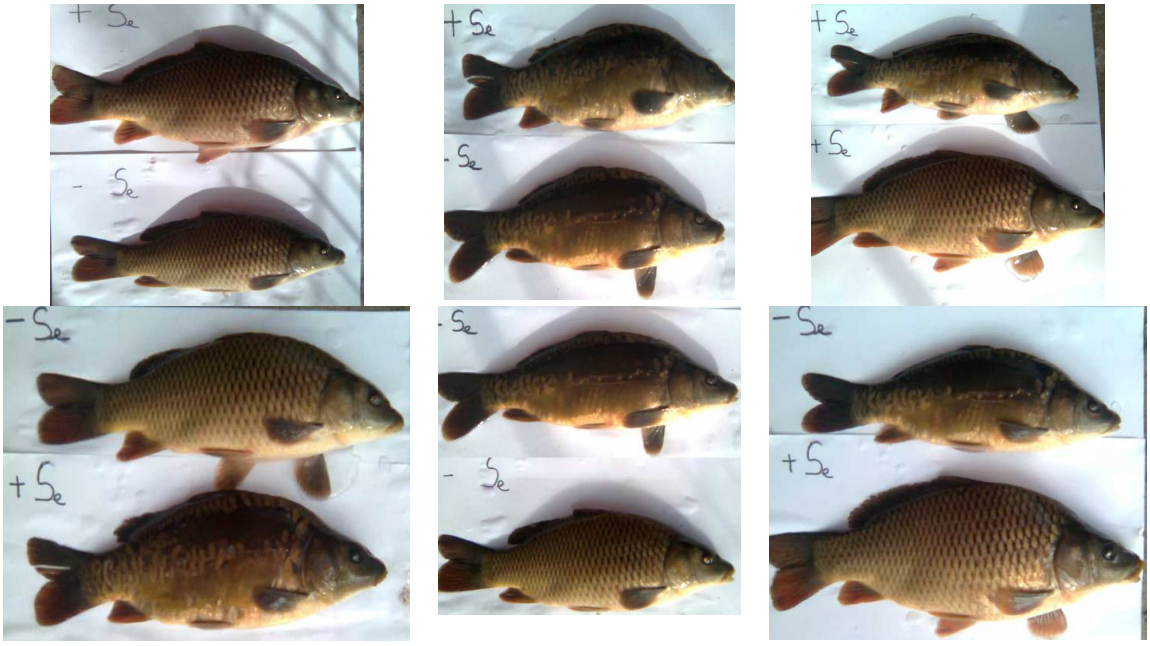

Fig. 3. Comparison between the maximum body weight of the four juveniles sets (+Se = from experimental batch; -Se = from witness batch).

The Dunn test reveals significant differences between the body mass of the experimental and witness batch. The Galitian experimental set gives better results compared to the Lausitz witness set, while the results corresponding to the Lausitz juveniles are even better.

The survival rate analysis reveals high values for the experimental batch, for both varieties.

Tab. 5

Statistical parameters regarding the mean body mass at the end of the experiment

Parameter	Individuals	Mean ± sx	v %
Mean body mass of ML (g)	194	276.804±0.051	3,50
Mean body mass of EL (g)	198	354.619±0.088***	4,29
Mean body mass of MG (g)	94	266.382±1.457	0.375
Mean body mass of EL (g)	98	283.265±1.287*	2.145

*** - P value <0.001% - very significant

* - P value <0.05% - significant

Tab. 6

Survive rate at experimental period end

Parameter	ML	MG	EL	EG
Number of juveniles at the beginning of experiment	200	100	200	100
Number of living juveniles at the end of experiment	194	94 ^{ns}	198 ***	98*
Percent losses (%)	3%	6%	1%	2%
Survival rate (%)	97%	94%	99%	98%

*** - P value <0.001% - very significant

* - P value <0.05% - significant

^{ns}- P value >0.05% - not significant

The Dunn test shows very significant differences between the batches, revealing the better performances of the experimental set of Lausitz variety.

All presented results confirm the benefits of using organic Se in the nutrition of common carp. The natural decision after this experiment is its application to other fish species and age categories.

CONCLUSIONS

The use of organic Se in the nutrition of Lausitz and Galitian common carp juveniles give results leading to the statements below.

- Sel-plex had a positive influence on the common carp juveniles body mass.
- At the end of the experiment the Lausitz variety from the experimental sets had the best performances compared to the other sets. The registered mean body mass was 354.619±0.088 g/specimen.
- The survival rate of the experimental batch was higher than the survival rate of the witness batch.

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